SCIENTIFIC AMERICAN

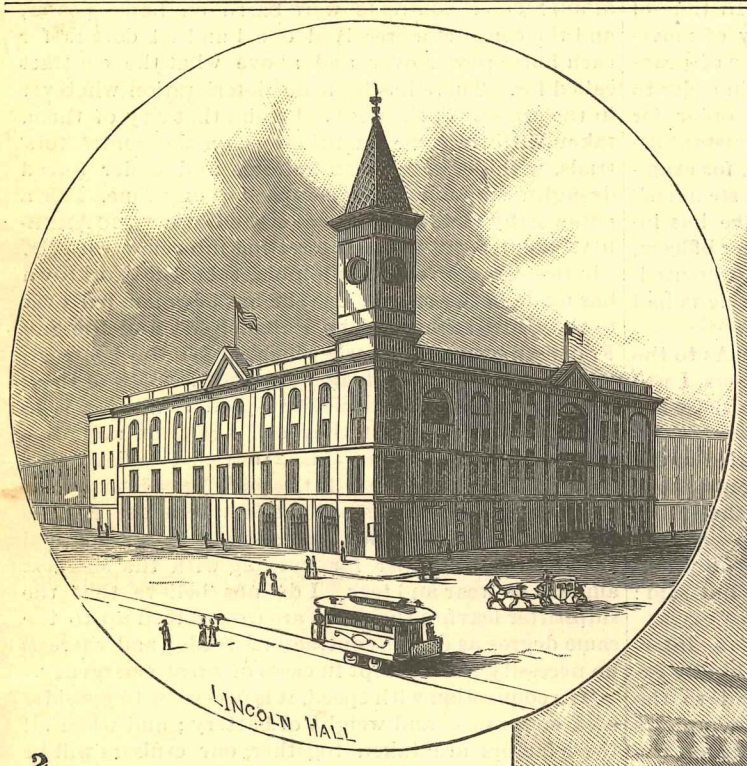
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1891, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

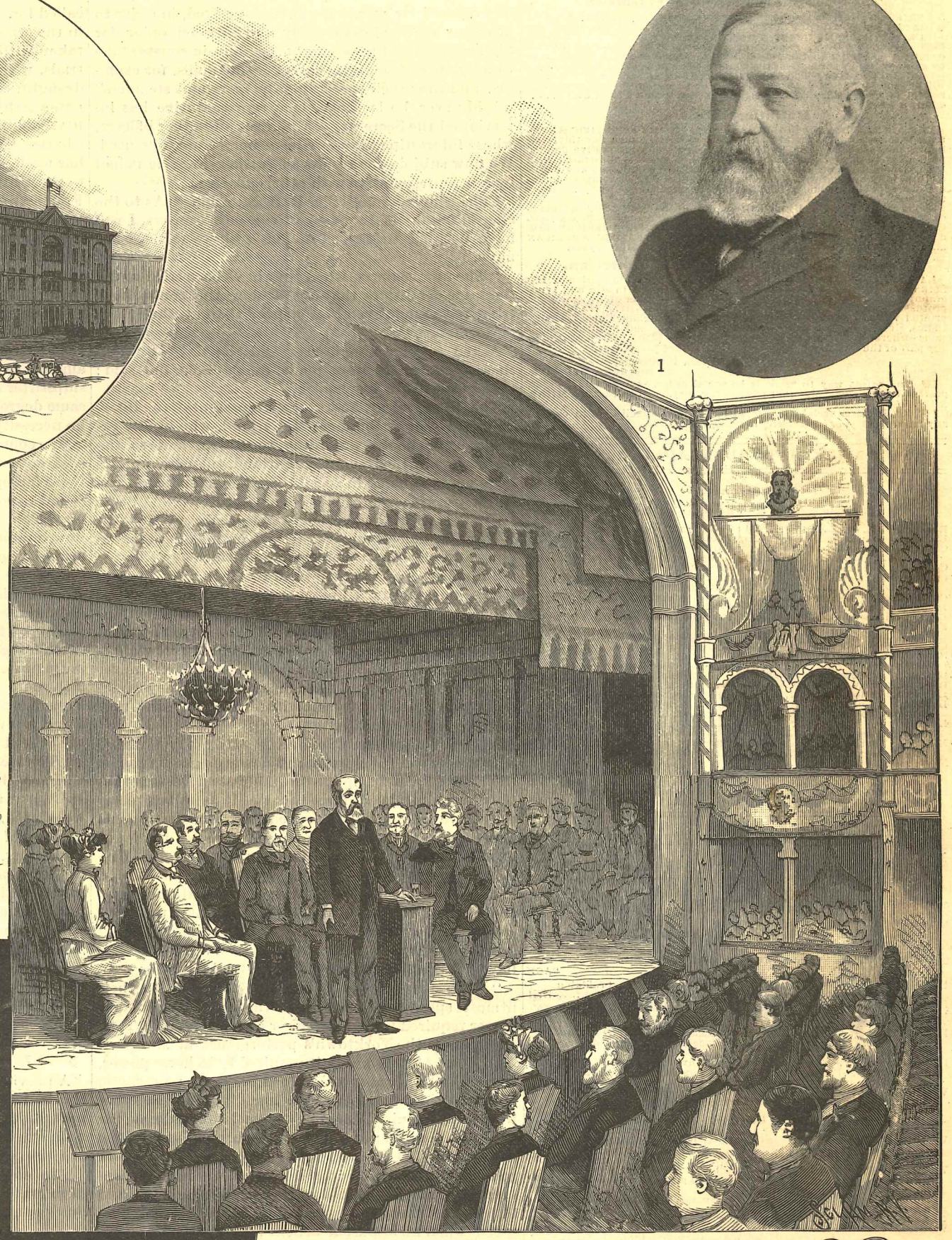
Vol. LXIV.—No. 16.
ESTABLISHED 1845.

NEW YORK, APRIL 18, 1891.

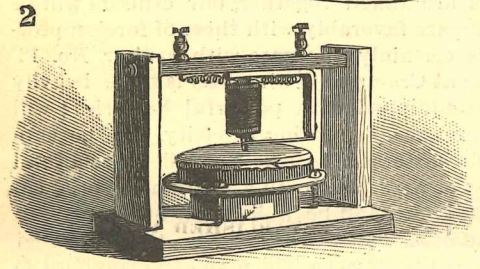
$3.00 A YEAR.
WEEKLY.

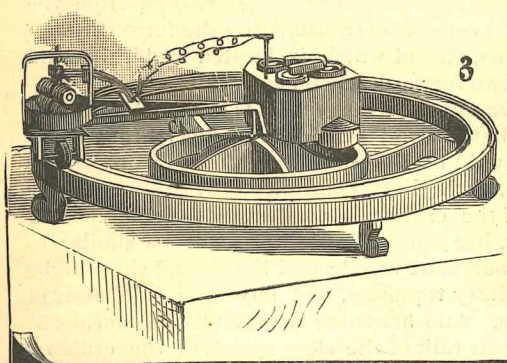


1

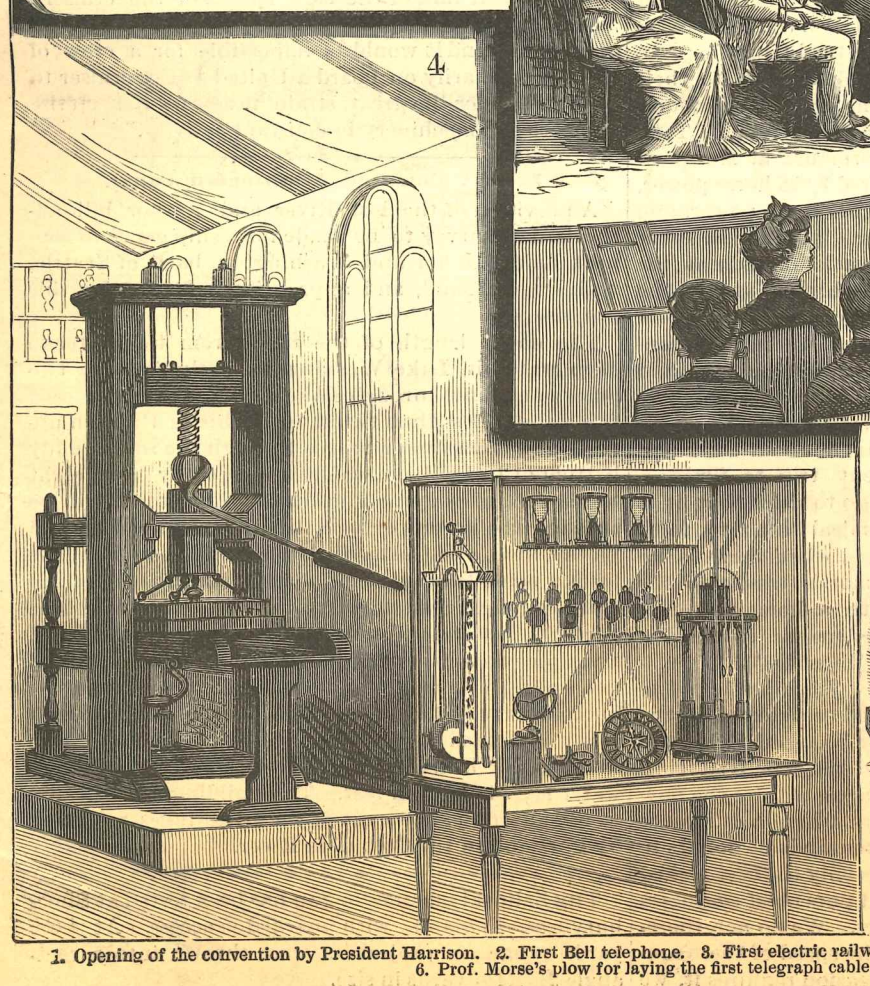


2

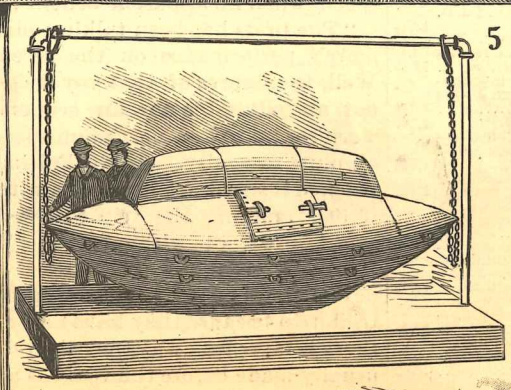




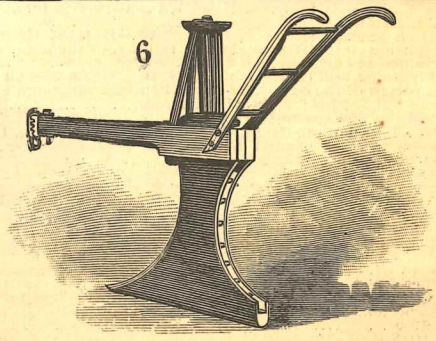
3



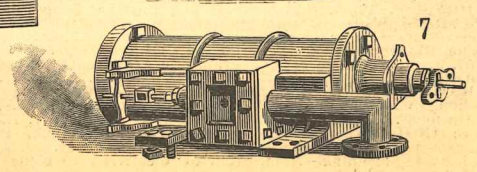
4



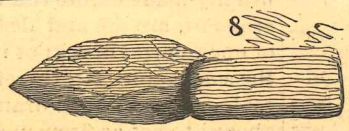
5



6



7



8

1. Opening of the convention by President Harrison. 2. First Bell telephone. 3. First electric railway (Davenport, 1837). 4. Franklin's press and antique horological exhibit. 5. First Francis life saving car boat. 6. Prof. Morse's plow for laying the first telegraph cable. 7. First locomotive cylinder. 8. Early savage cutlery; flint knife.

CENTENNIAL CELEBRATION OF THE ESTABLISHMENT OF THE UNITED STATES PATENT SYSTEM.—[See page 243.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico..... .....$3 00
One copy, six months, for the U. S., Canada or Mexico. 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *nine dollars a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. It has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, $5.00 a year; combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign countries, $11.50 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, APRIL 18, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

Barnum, P. T., dead..... 241
Books and publications, new..... 250
Canal, Lake Union and Washington..... 240
Cardboard machine, McCoy's.... 249
Cloth pressing machine, an English*..... 247
Cutlery used by savages*..... 239
Dental pain, diagnosis of..... 249
Electric railway, first, 1837*..... 239
Furnace, American blast, in England..... 245
Galvanometer, sensitive..... 245
Glass cutting by means of heat.. 245
Inventions recently patented.... 250
Inventors, chances for..... 241
Iron, pig, storage yards for*..... 246
Life boat, the first Francis*..... 239
Locomotive, cylinder of the Stourbridge Lion*..... 239
Locomotives, heavy, for St. Clair Tunnel..... 246
Mitchell, Commissioner, on our patent system..... 243
Navy, speed in our new..... 240
Patent centennial celebration*.. 239
Palladium plating..... 245
Patents, consideration of, in forming the Constitution..... 241
Patents and copyrights..... 245
Patents granted, weekly record. 251
Patent Office, Washington, exterior view and Model Hall*.. 243
Patented, what may be..... 246
Photographic shadow pictures.. 248
Physicians, negro..... 249
Picture frame hanger, Rulon's*.. 246
Pitch, coal tar..... 242
Printing press worked on by Franklin*..... 239
Railway ties, wooden *vs.* metallic 245
Refrigeration, coal ammonia for 241
Rust..... 249
Steamer, steel, launch on Lake Michigan..... 242
Suggestions for dyspeptics..... 249
Telephone bell, the first*..... 239
Telephone, life saving..... 245
Tooth extraction, electricity in.. 248
Tunnel, Hudson River, progress of..... 241
Ultramarine..... 241
Water filter, Darragh*..... 249
World's Fair, Chicago, education at..... 246
World's Fair, Illinois Building*.. 242
World's Fair, plans for dedication exercises..... 248

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 798.

For the Week Ending April 18, 1891.

Price 10 cents. For sale by all newsdealers

PAGE

I. AGRICULTURE.—Onion Culture for Pickling.—The profitable cultivation of onions from an English standpoint..... 12754
II. ARCHÆOLOGY.—The Amenide Mummies at Thebes.—An extremely valuable and interesting discovery of Egyptian mummies..... 12753
III. ARMS OF WAR.—The Mannlicher Magazine Rifle.—The famous Continental arm designed for use as a magazine rifle only.—7 illustrations..... 12748
IV. ASTRONOMY.—How to Measure the Invisible.—By HENRY M. PARKHURST.—Popular treatment of some of the recondite problems of astronomy..... 12755
V. BIOGRAPHY.—Dr. Otto and his Invention.—Biographical notes of the inventor of the gas engine.—The essence of his invention.—With portrait.—1 illustration..... 12751
The Inventions of Thomas Davenport.—By FRANKLIN L. POPE.—Early work in telegraphy by a contemporary of Morse..... 12744
VI. CHEMISTRY.—Spontaneous Combustion.—By ROBERT R. TATLOCK.—Spontaneous combustion.—Suggestions for avoiding its dangers..... 12752
VII. CIVIL ENGINEERING.—Sea Wall to Protect Iron Ore Mining Operations.—A great sea wall for the protection of the Cumberland iron ore mines.—2 illustrations..... 12750
The Rainey Bank Tramway.—A suspended wire rope tramway across the Youghiogheny River in Pennsylvania for transporting coal.—1 illustration..... 12749
VIII. ELECTRICITY.—A Great Dynamo for the Paris Central Lighting Station.—An immense dynamo in construction for use in Paris.—3 illustrations..... 12743
High Speed Electric Railway Work.—By O. T. CROSBY.—Experiments on the Weems electric railway.—Tabulation of results obtained and discussion of details.—5 illustrations..... 12745
Lightning Rod Protection.—By N. D. C. HODGES.—An interesting review of the conditions of the lightning discharge and means to be adopted for protection therefrom..... 12744
Note on Storage Battery Cars..... 12747
Train Shed of the Grand Central Passenger Station, Chicago.—Illumination by electric lights of the great passenger station of Chicago.—2 illustrations..... 12748
IX. MATHEMATICS.—A Simple Elliptograph.—An exceedingly simple apparatus for drawing ellipses.—1 illustration..... 12752
X. MECHANICAL ENGINEERING.—Boring and Chuck Lathe.—A lathe of peculiar construction for work upon large castings.—1 illustration..... 12750
XI. MISCELLANEOUS.—The Italian National Exhibition at Palermo.—Note on the exhibition and view of the site and buildings. 12754
XII. NAVAL ENGINEERING.—A Steering Screw Propeller.—A propeller attached to and moving with the rudder.—3 illustrations.... 12749
Service from La Goulette to Tunis by Boat.—The introduction of a peculiar type of passenger boat for service in Africa.—1 illustration..... 12749
XIII. PHYSICS.—Photography of Jets and Bursting Soap Films.—Prof. Rayleigh's recent work upon surface tension, with illustrations of the remarkable photographs obtained.—6 illustrations.... 12752
The Rejuvenescence of Crystals.—An interesting lecture by Prof. J. W. JUDD on crystallography as exhibited by minerals and salts..... 12757
XIV. RAILWAY ENGINEERING.—Heating Cars with the Thermo-Siphon.—A method of heating cars by hot water in France.—2 illustrations..... 12750
XV. TECHNOLOGY.—Bleaching by Permanganate of Potash.—Present aspect of the place of this salt as a bleaching agent..... 12758
Electric Bleaching.—Application of electricity to bleaching, with figures and data..... 12757
Otto of Roses.—How oil of roses is prepared and the cultivation of the plants.—6 illustrations..... 12755
Tin from Tin Plate Scrap.—By HERR B. SCHULTZE.—The recovery of tin by chemical process from scraps..... 12758

SPEED IN OUR NEW NAVY.

We have heretofore pointed out that there appeared to be a conspicuous falling off in the speed of our new war ships as soon as they left the contractors' hands. We have also called attention to the fact that this is not the case with the large first class mail steamers in the merchant marine. These boats continue in active service, year in and year out, and yet maintain, on nearly every voyage, the same high speeds they originally exhibited on their trial trips. We have asked why our new naval vessels, built and supplied, as they are supposed to be, with the very latest and best appliances, should not, in like manner, be able to run at all times as fast as the contractors made them go. In time of war, in critical moments of action, celerity of movement might be of vital importance. In time of peace be prepared for war. We have suggested, in order to have our ships always ready and in good order for high speeds, that they might be kept in constant action by employment in carrying the mails, for example, and thus their speed, like the merchant steamers', would never be lacking. Our representative has interviewed the Secretary of the Navy and other officers, whose interesting views we have heretofore presented. We now subjoin the results of further interviews had by our representative with other officers:

Chief Engineer Melville, U. S. N., said: "As to the alleged falling off in speed of the new cruisers, I will have nothing to say. I do not wish to criticise the navy.

"The new cruisers, when they have been tried under the same conditions that obtained at the contractors' trips, have made even better speed than at the initial performance."

Asked to give the figures and the days on which these later trials were made, he declined, but said: "They are in the log books."

The SCIENTIFIC AMERICAN representative interviewed Assistant Engineer McFarland, who kindly exhibited the books, according to which, and to the statements of Lieutenant McFarland, the new cruisers have never equaled in speed the records made on the trial trips.

The reporter then asked Chief Engineer Melville, "What is the best way or method of keeping the engines and men up to their maximum efficiency?"

"The best way to accomplish this is to dock the vessel regularly every three months, clean her bottom, and sheathe her, put a sufficient and an efficient force aboard, and all will then have been done that is necessary. The idea of carrying the mails in the new cruisers is not a bad one, but for the fact that the naval vessels are not adapted to such service, and they would never prove satisfactory substitutes for the vessels now engaged in that service."

Assistant Engineer McFarland said: "The reason why the new cruisers have not made as good time on their subsequent trips as on their trial trips is that they have not been forced to it. It is unfair to say they have fallen short in speed, because there was no effort made to have them equal the speed developed on the contractors' trip. Economy is the great consideration in the management of the new vessels, and it would be an enormously expensive operation to keep the cruisers running up to anything like the trial speeds."

"Then the speeds of the later trials of the new vessels have not equaled the speeds of the trial trips?"

"No, because we did not wish to put them to their utmost speed, on account of the tremendous horse power required to run a cruiser at high speed. Take for example the Yorktown's performance at Newport. At a speed of 19·44 knots it required 3,225 horse power, a speed of 13·18 knots called for 1,025 horse power, and a speed of 14·82 knots, 1,585 horse power. In other words, the required horse power varies directly as the cube of the speed; and indeed at higher speeds the equation is $I. H. P. = K. S.^{3·5}$. This increase of horse power calls for a corresponding increase in coal consumption, and it is apparent how extravagant it would be to keep the cruisers running up to their highest speed when no apparent benefit is to result.

"The press has been talking much about the Baltimore's performance on the recent trip to Sweden. Well, the figures of that voyage go to show that it is not an advisable nor an economical thing to force a cruiser up to her maximum speed when there is no absolute necessity. On the Baltimore's trial trip she reached a speed of 19·8 knots with a horse power of 10,100; and on the trip to Sweden she recorded a speed of 10 knots with a horse power of 1,500."

Chief Constructor Theodore D. Wilson said: "The new cruisers do not reach the speed established on the trial trip because they have never been put to it; and there is no reason why they should be. The trial trips, usually made before the vessel is accepted by the government, are life and death affairs, where a difference of one-quarter of a knot means thousands of dollars to the contractor. He, therefore, uses only the best picked coal, employs forced draught, and puts chief engineers aboard to act as firemen and oilers. We do not, therefore, in subsequent trips attain the speed of these contractors' trials, but, when the occasion requires it, we can, by thoroughly cleaning the bottoms and overhauling the ships generally, make a record for speed which will compare favorably, class for class, with any vessels in the world. The prevailing idea concerning the trial tests of vessels built for the United States government is that the trial trips are made on the measured mile and that speed is the quality which the contractors seek to demonstrate as being present in their vessels. This is a very erroneous idea, and to it many of the false conclusions regarding the new navy are to be attributed.

"The Baltimore and Newark, the Bennington, Concord, Petrel and Charleston, were not tried for speeds at all. Their contracts were based on horse power, and the contractors received one hundred dollars for each horse power over and above what the contract called for. There has been no deterioration whatever in the cruisers of the navy. I claim that any of them, taken with the same conditions as on the contractors' trials, with perfectly clean bottoms and under forced draught, can make the same speed at any time. It is a noteworthy fact, and one which the SCIENTIFIC AMERICAN pointed out in the interesting interview with Mr. Charles Cramp, of Philadelphia, that the Yorktown has made better speed since she has been handed over to the United States. The Philadelphia and the San Francisco were two vessels which, under the contract, were to have a speed of nineteen knots. Both of these vessels exceeded the stipulated speed, and there is to my mind no doubt but they can again at any time make as good speed as this. Indeed, I believe that with the same pressure a little more speed than this can be attained, because of the fact that the engines are worn down smoother, and are now better adapted each part to the other for working with the smallest amount of wear and tear. I do not believe that the ships after leaving the yards are ever forced up to the same degree as on the contractors' trials; and there is no necessity for it except in cases of great emergency.

"In connection with speed, it is necessary to consider coal endurance and weight of battery; and when all these factors are taken together, our cruisers will be found to compare favorably with those of foreign powers. This is certainly the case with cruiser No. 12, now building at Cramp's. This vessel is to be heavily armored and equipped with powerful batteries; will also have a great coal-enduring capacity, and be capable of high sustained speed. She will have a total displacement of 7,400 tons, with a sustained speed capacity of 21 knots, and be able, in an emergency, to reach a speed of 22 knots, in which case the indicated horse power will be 23,000. The plan of arranging the motive power appliances has been borrowed from the French, and consists in transmitting the force through three screws, one of which is located amidships and the other two forward, one on each side.

"The idea of this arrangement is to distribute the I. H. P. so that instead of 10,000 passing through one shaft, as would be the case if ordinary twin screws were used, each shaft transmits only 6,850. As the business of the cruiser is to destroy the commerce of the enemy, her general appearance will be similar to that of a merchant vessel; and to this end she will be minus military topmasts, and have her sides clear of projections. Another thing should also be considered when we hear talk of the slow speeds of the cruisers. There is a limit to the endurance of the men in the engine rooms, and it would be impossible for a crew of the size ordinarily on board a United States cruiser to continue under the great strain necessary to keep the furnaces and machinery in constant activity."

Lake Union and Washington Canal.

A provision of the last River and Harbor bill authorized a survey to be made for a ship canal to connect Lakes Union and Washington, back of Seattle, with Puget Sound, and appropriated $10,000 for this purpose.

The entire length of the canal, from tide water to deep water in Lake Washington, including the two miles of channel through Lake Union, will not exceed five miles. Less than two miles of this is through upland, and more than a mile is through the soft, muddy bottom of Union Bay, which is covered by from eight to ten feet of water. The upland excavation will be through the lower portages between Union Bay and Lake Union, and Lake Union and Salmon Bay, the former being three-eighths of a mile and the latter one and one-fourth mile in length. Through both of these portages flow streams of water—canals about the size of a millrace have been dug by private enterprise several years ago. The maximum cut will be in the neighborhood of forty feet, and there will be no excavating in rocky or difficult formations, while the elevation to be overcome by locks from the level of the sea to fresh water level is but ten feet. The building of this canal would afford Seattle some of the advantages possessed by Portland in the Columbia River.

THE Zalinski pneumatic gun has been tested at Shoeburyness, England, with marked success. At 4,000 yards range six projectiles were thrown into a rectangle 2½×1½ yards in size.

Progress of the Great Railway Tunnels under the Hudson River.

Independently of the engineering and mechanical difficulties pertaining to the prosecution of this remarkable work, the simple labor of removing the excavated mud or earth is a job of no inconsiderable magnitude.

The diameter of the excavation is 19 ft. 11 in., and the superficial area of the heading excavated is about 313 ft. For each running foot of advance made by the hydraulic shields about 313 cubic feet of excavated material must be removed. Up to the present time not far from 3,500 ft. of completed tunnel have been built, leaving a length of about 2,000 ft. yet to be bored before tunnel communication is established between the New York and New Jersey shafts. This refers to one of the tunnels only.

The other tunnel is not so far advanced. The quantity of excavated material daily removed from one tunnel is not far from 2,000 cubic feet, all of which has to be passed out through double air locks of only 3×4 ft. area.

Power to Grant Patents for Inventions—Proceedings of the Framers of the Constitution in 1787.

BY LEVIN H. CAMPBELL.

The proceedings in the federal convention relating to the insertion in the Constitution of a clause giving power to Congress to grant patents for inventions may be briefly told. On May 29, 1787, Edmund Randolph, of Virginia, opened the business of the convention by submitting a series of resolutions known as the "Virginia Plan;" then Charles C. Pinckney, of South Carolina, laid before it the draught of a federal government which he had prepared. There was no mention in either of these schemes of any power to grant patents. They were referred to a committee, and the committee subsequently reported in favor of Mr. Randolph's plan; which, however, had been amended in the committee of the whole house. Still no reference to such a power was made. Discussion of the "Virginia Plan" was postponed until Mr. Patterson, of New Jersey, could submit a plan. Both of these plans were referred to the committee of the whole, which reported again in favor of Mr. Randolph's plan as the basis of the Constitution. After debating the report for over a month, all the proceedings of the convention up to that time were referred to a committee of detail appointed for the purpose. Thirteen days later the committee made a report, but still there was no provision for granting patents. These details of the proceedings of the convention are only given to show that practically the Constitution had been agreed upon before it occurred to any member to suggest the power of granting patents. August 18, nearly three months after the convention had been in session, James Madison, of Virginia, arose in his place and "submitted, in order to be referred to the committee of detail, certain powers as proper to be added to those of the general legislature." Among these powers were two: "To secure to literary authors their copyrights for a limited time," and to "encourage by premiums and provisions the advancement of useful knowledge and discoveries." On the same day Charles Pinckney, of South Carolina, also submitted a number of propositions, among which were: "To grant patents for useful inventions," and "to secure to authors exclusive rights for a certain time."

The propositions of both these gentlemen were referred to the committee. On August 31 such parts of the Constitution as had not been acted on were referred to a committee composed of one member from each State, and among these undisposed parts were the propositions to give Congress the power to grant patents for inventions. Mr. Madison, but not Mr. Pinckney, was of this committee. On September 5 the committee reported and recommended, among other things, that Congress have the power "to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." This was agreed to without a dissenting vote. In the final revision of the style and arrangement of the articles in the Constitution this clause became paragraph 8, section 8, of article I., where it has ever since remained.

Thus it is seen that the distinction of submitting the proposals to give this power to Congress rests jointly with James Madison and Charles Pinckney. Both of them were revolutionary patriots of marked ability and wide legislative experience, but neither appears to have had any special interest in science or the useful arts. They doubtless were prompted to this action by the same motives advanced by Mr. Madison in a paper in the *Federalist* in adverting to this power. He wrote as follows: "The utility of this power will scarcely be questioned. The copyright of authors has been solemnly adjudged in Great Britain to be a right at common law. The right to useful inventions seems with equal reason to belong to the inventors. The public good fully coincides in both cases with the claims of individuals. The States cannot separately make effectual provision for either of the cases, and most of them have anticipated the decision of this point by laws passed at the instance of Congress."

Time has justified the equity of Mr. Madison's argument, and the neglect and failure of the States to grant patents for inventions since the adoption of the Constitution have corroborated its truth.—*Mag. of Amer. History.*

Coal Ammonia for Refrigeration.

Speaking recently to the N. E. Gas Engineers concerning the values of residuals from gas coals, Mr. G. Shepard Page said:

In New York, Baltimore, Washington, and scores of other cities and towns it has been found that even in the manufacture of twenty-five tons of ice per day it can be produced and sold at a profit in competition with natural ice. Cold storage warehouses are increasing, and the majority of them would not be profitable without this artificial refrigeration. The results which have been gained in that direction are such that, no matter how cheap natural ice is, or how easy it can be put into a building, an ice machine which will make twenty different temperatures in twenty different rooms will be preferred. There are all manner of articles, otherwise perishable, which can by artificial refrigeration be kept for one year, two years, or three years. Just under the Brooklyn Bridge, in two of the great arches, there is a cold storage warehouse; and Mr. McLean, of Brooklyn, a well known dry goods merchant, stops occasionally to call upon his son, who is one of the proprietors, and he will say, "Now, if you please, I will have a chop off that mutton that was put in here three years and a half ago. I think it is a little sweeter the older it grows." I frequently stood at the great warehouse on the Thames and have seen the barges that have taken out the carcasses of mutton from the big steamers that land them at the docks down below on the Thames, which are stacked up just like cord wood, handled like cord wood, and put under the great arches of the Cannon Street Bridge, in rooms holding 80,000. There you find mutton from New Zealand and South America, artificially frozen at the start, kept frozen on the voyage, stored in those storehouses under the great arches of the bridge, and delivered frozen to the retailers. All the meat that is being sent by Armour, Hammond, Eastman, and other shippers from this side across the ocean is preserved by artificial means. Hence the demand for the ammoniacal liquor of even the smaller gas works. Add the value of the ammonia to the price of coal tar, and the two added to the receipts for coke, is making a figure on the credit side that has never before been realized.

Ultramarine.

Friedrich August Kottig was the director of the laboratories of the Royal Porcelain Factory at Meissen, and, if every one were given his due, should be known as the discoverer of artificial ultramarine. This honor is usually divided between Guimet and Ginelin, who, however, were still fighting hard for the whole of it when Kottig first began to make ultramarine on a large scale.

In the spring of 1828, Kottig was in want of a glass free from lead, and set about making sodium silicate for this purpose out of a pure clay. The frit contained an earthy blue substance, which was speedily identified, and by January, 1829, artificial ultramarine was thrown on the market.

The Meissen ultramarine, says J. Heintze, in the *Journal fur Praktische Chemie* (1891, No. 2), was always a greater favorite and fetched a higher price than most other brands, and since the factory is now closed it is worth while to put on record the exact method which was there adopted in this manufacture. It was soon found that the slightest trace of sulphate or sulphite in the soda injured the brilliancy of the color, and chemically pure crystallized sodium carbonate was employed. The percentage of silica in the clay was also found to be an important point, and the kaolin of Seilitz, English porcelain clay, China clay, and kaolin from Zeltlitz by Carlsbad, rapidly displaced the porcelain clay of Morl by Halle, which is a little richer in silica than the aforesaid varieties. The sulphur was Sicilian roll crushed in iron roller mills, and the charcoal was from pine and similarly crushed.

Fifty parts of the sodium carbonate were thrown into a cast iron dish, shaped like an evaporating basin, 1 meter in diameter and 0·3 meter deep, placed directly over a fire. When the soda had melted in its water of crystallization, 20 parts of the levigated kaolin were added in small quantities, but pretty quickly, the mixture being kept stirred with an iron stirrer, and the fire kept low until the mixture had evaporated to dryness. The color basis thus obtained amounted to some 32 parts of the materials taken, and to every 19 parts of this 6 parts of powdered sulphur and 1 part of powdered charcoal were added. Should a brand of greener tinge have been required, the sulphur would have been reduced to 4 parts; in fact, all the different shades were made by altering the proportions. These materials were then most intimately mixed in a porcelain mill for 10 hours; the success of the subsequent processes depending on the intimacy of this mixture, it was only deemed sufficient when no individual particles could be detected in a thin layer of it. The mixture was then transferred to open, flat, round capsules, made of chamotte, a burnt clay, and of such a size that each would only be three-quarters full when it contained 250 grammes of material, forming a layer, when gently pressed down, some 3·4 centimeters deep; 50 kilogrammes of mixture were generally contained in 200 or 202 capsules. The capsules were then burnt in muffles. These were about 0·4 cubic meter capacity, and held at least 216 capsules in nine layers of 24 capsules in rows of six by four. Latterly, large crucibles were used, but the muffles were the best.

The craft of ultramarine making is in the first burning, which must not be too much or too little. If the muffle furnace is provided with a chimney which can be opened or closed, coal can be burnt, but care must be taken that the flame is oxygen free. At Meissen the temperature in the muffle oven was allowed to rise to yellow, which normally took 2¼ to 2½ hours, and the cooling was made as slow as possible by closing the dampers. If the burning is successful, the mass of raw color is very pale blue or bluish-gray and very friable. It should be homogeneous and easily rubbed down between the fingers and thumb; if it is underburnt it will not be uniform in color, and will be useless for further treatment; if, on the other hand, it is overburnt it will have sintered and will be destitute of blue color.

The next process is the removal of all soluble salts, which was performed at Meissen by washing with cold water till the washings left no appreciable residue. The mud was then dried in capsules in the oven and sifted through a medium sized mesh, through which it should be easily rubbed with the hand, unless it is overburnt. The color has now to be burnt a second time, in order to remove some greenish sulphur compounds by oxidation. The same capsules and muffles were used as in the first burning, only the capsules were so packed as to allow free access of air, but at the same time the muffles were closed to prevent entrance of furnace gases. There was sufficient air in the muffles for the necessary oxidation. The temperature was allowed to rise to red heat, but was regulated according to the success of the first burning; if the color had sintered at all, the temperature of the second burning was raised; if, on the other hand, it was underburnt, the temperature was lowered in the second burning. The color at first became nearly black and gradually more and more blue. Just before the full blue was reached the dampers were closed and the heating discontinued; the full color then developed during the cooling. The second burning generally lasted some 2½ hours.

The final operation in the preparation of ultramarine is nearly a mechanical one. Some 25 kilogrammes of the color are washed with water containing 100 grammes of magnesium carbonate, or 250 grammes of powdered chalk, and rubbed to a fine powder the while. Passing through a hair sieve, drying, and *adulterating the cheaper brands with clay*, completes the manufacture.—*Chemical Trade Journal.*

P. T. Barnum Dead.

The greatest showman on earth, as he prided himself on being called, died at his home, in Bridgeport, Conn., on the 7th inst., after a protracted illness.

Mr. Barnum was deservedly popular among all classes, and the city in which he had long lived, and where he died, has lost one of its most public-spirited and useful citizens.

Mr. Barnum's energy was exhaustless, and he took great pride and delight in his own achievements. He was a striking example of what perseverance and assurance can accomplish. Forty years of his life was devoted to the show business, in which he had no peer. He understood the business and enjoyed it, and he has left a large fortune as the result of his active life.

The veteran showman was probably the best known man in the United States. He has made a succession of generations of children happy, and his genial face, with "I am coming," which ornamented part of the gigantic bill announcing the coming show, will be recalled to the mind of multitudes in both hemispheres.

Chances for Inventors.

The Postmaster General has issued a public notice to patentees and their assignees inviting them to put in proposals for the use by the government of improved modes of construction of mail bags, of opening and closing mail bags, mail catchers, and devices for labeling mail bags. Proposals for the above will be received until September 2, 1891. Proposals for furnishing mail bag cord fasteners, iron, steel, brass, oil, and wastes, will be received until May 6, 1891. Particulars can be had by addressing the Postmaster General, Washington.

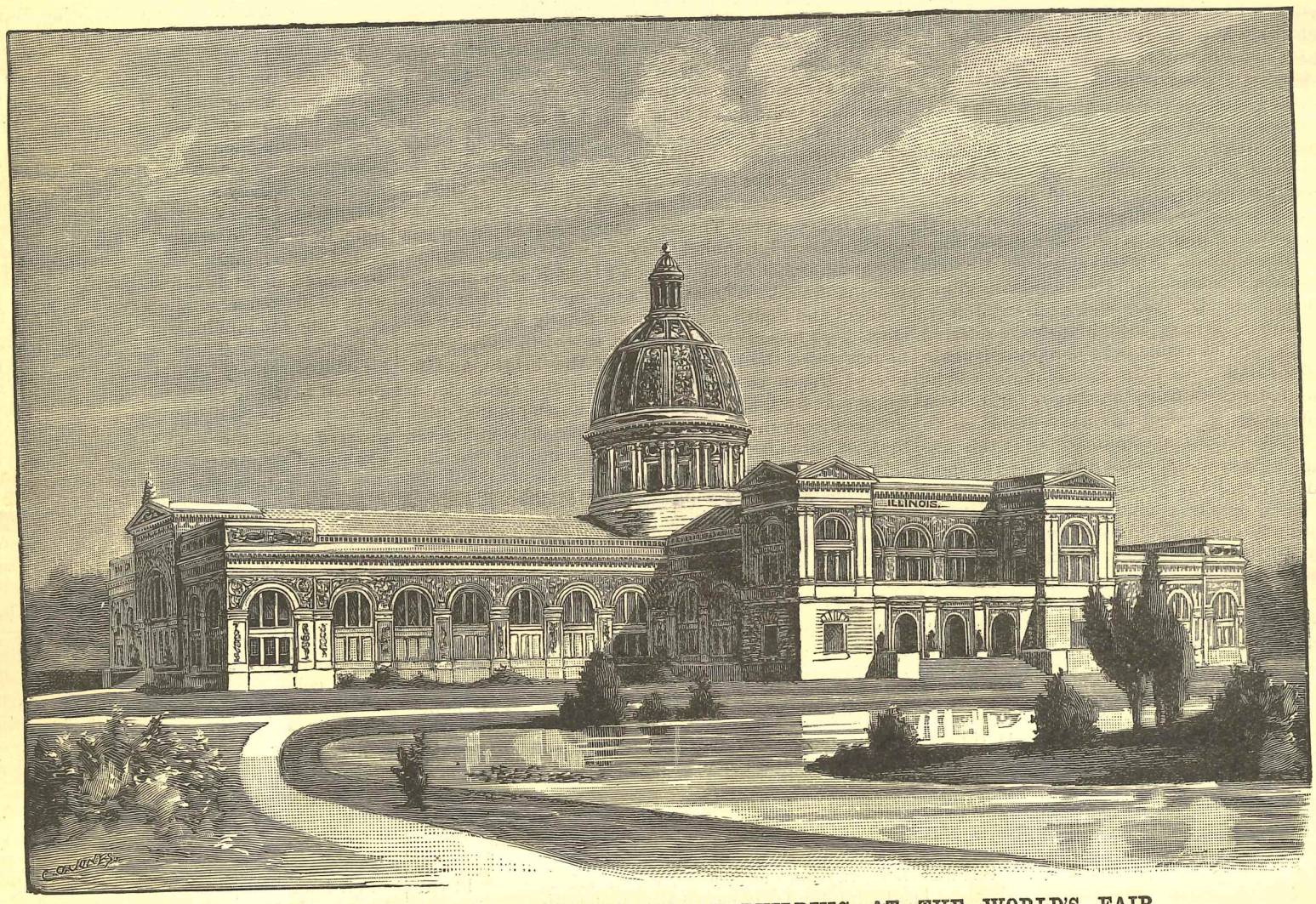
HON. DAVID A. WELLS, the eminent statistician and able writer on political economy, has been awarded a gold medal by the jurors of the French exposition of 1889, in recognition of his contributions to economic science and literature. A well deserved compliment.

THE ILLINOIS STATE BUILDING AT THE WORLD'S FAIR.

The Illinois State Building at the World's Fair will be located at Jackson Park, near where the boat house now stands on the artificial lake. A broad channel is to be extended from the southeast portion of the park to this lake, and the Illinois building is to front this waterway.

The structure is to be placed on a terrace four or five feet high, and in front of the entrances there will be stone terraces with railings, statues, and stone steps leading down to the roadway. The main features will be the terraces north and south, the south more important of the two, as from this point may be viewed the panorama of all the magnificent fair buildings, as well as the waterway.

The building is to be embellished with fine carving and statuary, the material to be cast blocks of some approved composition. It is to be thoroughly lighted, first from the side windows, which are placed about fourteen feet above the floor to permit cases to be placed against the walls; second, with skylights placed in the flat roof of the side aisles; and, third, with continuous skylights on the ridge of a pitched roof or nave. Ventilation is provided for through windows placed a story above the flat aisle roof and the foot of the sloping roof over the nave.



APPROVED DESIGN FOR THE ILLINOIS STATE BUILDING AT THE WORLD'S FAIR.

There will be three entrances—the prominent one to the south, one to the west facing the Midway Plaisance, and the other on the north end of the Memorial Hall, from the boat landing or the edge of the lagoon.

The building in the main is 160 feet wide by 450 feet long, with the school house, about 75×60 feet, taken out of the east end and within the building. The dome will be seventy-two feet in diameter and about 200 feet high, with a lookout about 80 feet high and another in the lantern about 175 feet high. The side walls are 47 feet high, while the center wing on the south will be 72 feet high, and both ends 54 feet, with a still higher projection in the center.

On the north the Memorial Hall will form a wing 50×75 feet, while on the south will be placed the executive offices in a wing 75×123 feet, carried up three stories, with a public hall in the third story. In addition to these offices, there are to be others in each of the four corners for the departmental officers.—*The Graphic, Chicago.*

Launch of a Steel Steamer on Lake Michigan.

The launch of the Minnesota Steamship Co.'s steel steamer Marina took place March 14 from the yards of the Chicago Ship Building Company, at 101st Street and Calumet River. Every vessel in winter quarters in the vicinity of the yards carried its streamers of bunting. More than 3,000 people witnessed the launch. The Marina is the first steel vessel ever built on Lake Michigan. Her length is 308 feet, keel 292 feet 6 inches, beam 40 feet, and depth 24 feet 6 inches. Her keel was laid last July. The Marina is designed for the ore trade.

Coal Tar Pitch.

At a recent meeting of New England Association of Gas Engineers, held at Boston, Mass., Mr. G. Shepard Page, of New York, said that many companies in the United States are receiving for the tar and ammonia almost the entire cost of the coal they are carbonizing. As much as $1.50 per ton of coal carbonized is being received by some companies in the West, and I think by some three, four or five companies, and perhaps more, in the East, for the tar alone.

While there has not been anywhere near this advance in value of the ammoniacal liquor, yet certainly a company that has not received twenty cents per ton of coal carbonized is not getting what the ammonia in the coal, if it is all properly obtained in commercial form, should bring them. The value of ammonia, however, is limited, and will continue to be limited, by the foreign market price of sulphate of ammonia. That can be laid down here for simply the commission, the freight, and the import duty from the other side, at a figure not far from 3¼ cents per pound. That, therefore, fixes beyond any question the value of the ammoniacal liquor.

The cause of the advance in coal tar is due, first, to the larger percentage of gas making by the water gas process; and, second, to the enormous advance and increase in consumption of coal tar products. There are already several establishments using pitch for making briquettes—the artificial fuel. There are large bodies of coal in the West and Southwest which when brought to the surface and exposed to the air very quickly become slack. They are very useful for steam purposes, and even for gas making, if they can be held in solid form. They can be put into that condition only by the use of coal tar pitch. Other materials can be used, but coal tar pitch is the best, because it will make steam when combined with the culm or slack. Several American railroads have erected artificial fuel plants; so that a demand has been created for a product which has heretofore been used to a very limited extent on this side; while on the other side nearly all the pitch that is made is used in that way. Certainly over 1,000,000 tons of pitch per annum are used in making fuel briquettes. Many of the railroads in Europe use almost exclusively fuel that is made in this way. They are thus able to utilize the slack, which they could do in no other way so advantageously. But all pitch that is being used for that purpose in this country is now being imported from Liverpool and London. No hard pitch is made here, because no anthracene is being produced here now. Furthermore, when distilling tar for pitch, it is difficult to "cut" it back with the oil and obtain a product that is durable for the uses to which most of the pitch is put here, and that is for gravel roofing. However, I am looking forward to a time when the anthracene and the alizarine business will be established here. I have no doubt it is to be located here. We will not continue to pay from five to six million dollars per year to England, France, Germany, Switzerland, and Belgium for a product which exists in our own coal tar, and which is required here by our dyers. Works will unquestionably be established.

Another great industry is becoming well established in the United States—the creosoting of wood for preservation from decay, and destruction by the marine worm. At the present time $\frac{19}{20}$ of the heavy oil of coal tar is used for wood preservation, and large quantities are being imported from the other side. Creosote oil is being shipped from London, around Cape Horn, for use on the Pacific Coast.

The use of the liquid or semi-fluid coal tar for stone pavements which have become so general—putting it in the crevices between the blocks to cement gravel—induces a very large consumption of tar, and in many of the concrete pavements coal tar is used. I know of one company, east of Boston, whose coal tar is going west to Chicago, to be used almost exclusively for that purpose. The consumption of tarred paper, under slate roofs and under weatherboarding, and in a thousand different ways, requires an enormous quantity of coal tar for saturation. Coal tar is being carried 1,200 miles in tank cars, and then used for saturating paper, finding its market then in the West. In the manufacture of the two-ply and the three-ply roofing, two layers of tarred paper are caused to adhere by using melted pitch. It is an entirely new industry within the past seven or eight years, and it will continue to use increasing quantities of coal tar. It makes the cheapest roof that can be put upon a house. A large proportion of the roofing in the West, and even to a limited extent in the Eastern and Middle States, is made in that manner A man can buy the two-ply or the three-ply paper, and five or ten gallons of the liquid cement (which is also coal tar with the lighter oil and a part of the heavy oil taken out), and he can find the gravel, or ashes, or cinders near by; and with a brush he can make a roof at a cost of from two to four cents per square foot, and one that will last from three to ten years. Therefore, that industry must continue. One of the largest uses of ammoniacal liquor is for artificial ice making. That industry was not born in this country, but it took root here earliest, and has now become of vast importance.

Cleaning Sheets of Wrought Iron, etc.

Wrought iron plates are pickled in hot dilute sulphuric acid in the ordinary way, commercial oil of vitriol diluted with 10 volumes of water being preferably used at a temperature of 200° F. The improvement consists in allowing the contents of the pickling tank when sufficiently concentrated to flow slowly through a long cooling channel and there deposit the greater part of the dissolved sulphate of iron, the mother-liquor passing into a vessel from which it is continually pumped back into the pickling tank, vitriol and water being added till it is of the proper strength. The process is continuous after being fairly started. Cylindrical pickling tanks are used for cleaning wire.—*E. P. Peyton, Birmingham.*

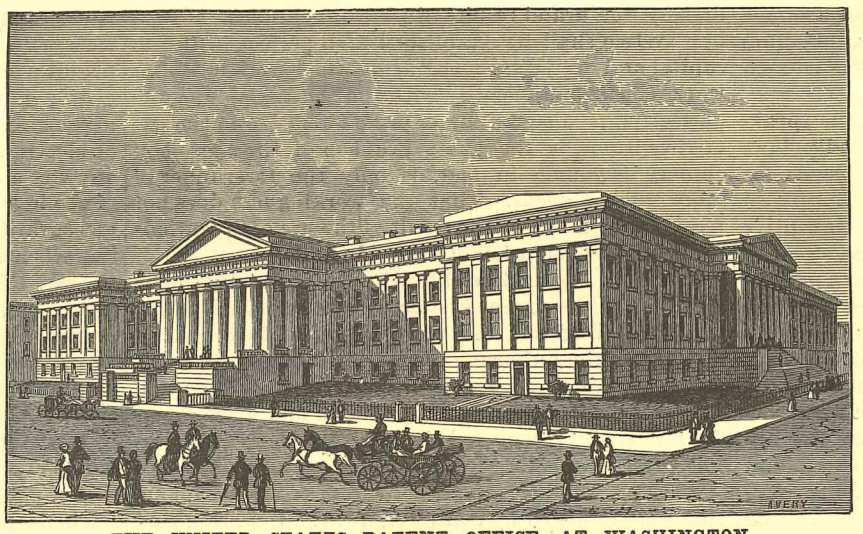
THE PATENT CENTENNIAL CELEBRATION—APRIL 8, 9, AND 10.

The notable group of eminent men assembled on the stage of Lincoln Music Hall, Washington, on the afternoon of April 8, at the opening c remonies of the centennial celebration of the American patent syst m, formed a picture which will live while memory lasts in the minds of all who were fortunate enough to be present, and one to which the brush or pencil of the artist and delineator can at best do but feeble justice. Our sketch of the inspiring scene will convey to scores of thousands, keenly appreciative of the significance of the occasion, some idea of its dignity and stateliness. The exercises were formally opened with a short address by the President of the United States, and this was the moment chosen by our artist for his view of the Congress of Inventors and Manufacturers of Inventions, which appears on the first page of this issue, and the business of which was continued through the afternoons and evenings of three days, April 8, 9, and 10.

In the group immediately behind and at the side of President Harrison were the Hon. John W. Noble, Secretary of the Interior; the Hon. Charles E. Mitchell, Commissioner of Patents; the Hon. Samuel Blatchford, Justice of the United States Supreme Court; Hon. John W. Lynch, Chairman of the Executive Committee; Hon. O. H. Platt, of Connecticut, U. S. Senator; Postmaster-General Wanamaker; Carroll D. Wright, the Commissioner of Labor, and as many thers as the stage would comfortably hold, all being representatives of the highest types of the progressive spirit of modern times. The audience, too, was almost entirely composed of men who had attained eminence in some department of life connected with the origination or development of inventions.

In opening the congress the President expressed his appreciation of the importance of the occasion, and hoped the gathering would be promotive of science and art. He thought it distinctly marked a great step in the progress of civilization when the law takes notice of property in the fruit of the mind. The ownership in the clumsy d vice which savage hands have fashioned from wood and stone is obvious to the savage mind; but it required a long period to bring the public to a realization of the fact that it was quite as essential that this property in impalpable thought, taking the shape of things useful to men, should also be recognized and secured. That was the work of the patent system as it has been established in this country. It could not be doubted by any, he thought, that the security of property in inventions was essential and highly promotive of the advance of our country in the arts and sciences. Nothing more stimulated effort than security in the result of effort.

After the President's remarks, Rev. Dr. Sunderland invoked the divine blessing, and then Secretary Noble introduced Commissioner Mitchell, who spoke on "The Birth and Growth of the American Patent System."



THE UNITED STATES PATENT OFFICE, AT WASHINGTON.

MODEL HALL, UNITED STATES PATENT OFFICE.

The patent system, said Commissioner Mitchell, had its birth in a statute against monopolies. That statute was enacted by a British parliament to sustain the British throne. From the earliest times the right to grant exclusive privileges had been asserted as a royal prerogative. Sometimes the power had been exercised beneficently. With vastly more frequency it was employed to bring in revenue to the royal coffers, more and more as the sovereign struggled to govern without the aid of parliament. The power was abused and perverted until in the days of Elizabeth monopolies were conferred upon favorites of the court, extending to the most ordinary articles of commerce and consumption. In aid of these illegal monopolies, arbitrary powers of search were granted, and heavy penalties were inflicted upon English merchants for engaging in occupations which had been of common right for centuries. Of course such tyranny could not continue, and in the year 1623 the famous statute of James was enacted, destroying all illegal monopolies by a single stroke, and declaring that in future all patents should be to inventors of new manufactures, and to them only for a limited time. It is to this statute that legal writers ascribe the modern patent system.

But although the patent system is ascribed to the statute of 1623, its administration was long pervaded by a spirit hostile to inventors. The benefactor of the public had to crawl before the king as a suppliant for favor. If his cringing was successful, his patent was granted, but he was dismissed with the poor privilege of proving the novelty of his invention as best he could. The patent was not even *prima facie* evidence that the patentee had made an invention. When it came into court, it was construed in a technical spirit, a spirit which assumed everything in favor of the crown and nothing in favor of the subject, and it is hardly too much to say that some of the earlier decisions in patent causes betray a temper that would hav better befitted a permit to sell gunpowder in the streets of London. In view of this judicial hostility, which robbed the law of its beneficence and transformed the statute into an ambuscade, it is no wonder that for a hundred and fifty years scarcely mor than one thousand patents were granted. It could make but little difference whether patents were denied or, having been granted, were denied pr tection.

But a more enlightened sentiment developed. Watt had harnessed machinery to steam and Arkwright had harnessed spinning to machinery. The patent to Watt, granted in 1769, had been extended by an act of parliament in 1775 and had run unscathed the gauntlet of the judge. Patents were granted with increasing frequency, and the useful art received a mighty impetus. Powerful infringers sought to trample upon the rights of patentees, and law suits followed that were fierce as battle fields. Judges began to regard inventors, not as recipients of royal favor, but as public benefactors worthy of the world's great prizes. Then came those days, memorable in judicial annals, when jurists who were in touch with human progress discussed anew the relationship of the inventor to the public, and, as if they had gotten foregleams of a new industrial era, laid down those broader and more generous principles which have become the foundation and framework of the patent law. The statute of James followed the Mayflower across the ocean. In the year 1641 the General Court of Massachusetts Bay granted a patent to Samuel Winslow for a method of making salt, and prohibited others from making this article except in a manner different from his. In 1646 a patent was granted to Joseph Jenks for an engine for the more speedy cutting of grass, the invention substituting for the short and clumsy English scythe a long, slender blade, supported by a rib along its back—a construction easily recognized as that of the modern scythe. The invention seems also to have extended to machinery for scythe making.

The name of Joseph Jenks—how inconsiderable the place which it occupies in colonial history! The antiquarian stumbles upon it and makes a memorandum in his note book, while the student of events that thrill and startle passes it without a thought or utterance. Nevertheless, a deep human interest invests it, and more and more it shall attract attention. Nor do we honor him less because the mowing machine and the reaper have eclipsed in brilliancy his more humble achievement, as there in the early wilderness he appeals to the general court for protection, so that, as he quaintly says, "his study and cost may not be vayne or lost."

Mr. Mitchell referred to patents issued by the colonies of Connecticut, Maryland and New York, showing, as he said, how deep-seated was the understanding, wherever the law of England had been inherited, that it was a just and beneficent exercise of the power of governments to protect inventors by patents for limited periods. The constitutional convention at Philadelphia had been in session nearly three months before its attention was directed to patents and copyrights. Mr. Mitchell then detailed the propositions brought in by Mr. Madison and Mr. Charles Pinckney, which resulted in paragraph 8 of section 8 of article 1 of the Federal Constitution. "Wise and illustrious men were they, these constitution framers," the speaker said, "but they had no conception of the importance of what they did when, just before the curtain fell upon their labors, they decreed that the exclusive rights of inventors should be secured. They thought they were applying finishing strokes and touches to an edifice which was otherwise completed, when they were really at work upon its broad foundations. For who is bold enough to say that the Constitution could have overspread a continent if the growth of invention and of inventive achievement had not kept pace with territorial expansion? It is invention which has brought the Pacific Ocean to the Alleghanies. It is invention which, fostered by a single sentence of their immortal work, has made it possible for the flag of one republic to carry more than forty symbolic stars."

The speaker then detailed the circumstances attending the passage of the first patent law of April 10, 1790. Under that law the Secretary of State, Secretary of War and the Attorney-General were to determine in each case whether a patent should be granted. From April to July they awaited a successful applicant. He comes at last, and three cabinet officers, Jefferson, Knox, and Randolph, sitting in solemn dignity, determine that Samuel Hopkins is entitled to a patent for his new method of making pot and pearl ashes.

"Does any one," Mr. Mitchell went on, "say that the office then discharged was unworthy of such a tribunal? Let him remember that patent of July 31, 1790, was the first of 450,000 patents. Let him try to imagine the condition of life and society if those patents had never been granted. Let him ask himself what adequate reason exists for the wizard-like transformations of a century, excepting the stimulus afforded by patent legislation. Let him compare the saddle and the pillion with the parlor car, the tallow dip with the electric light, the post boy with the lightning mail, the telegraph and the speaking telephone. Let him make a corresponding comparison in every department of life, along every line of progress, and he will see in the signing of that patent to Samuel Hopkins an act of historic grandeur." Fifty-seven patents in all were granted under the statute of 1790. A new act was passed February 21, 1793, which law prevailed, with some modifications, until the great law of 1836 was enacted.

"The act of 1836," said the speaker, "created an epoch. An eminent statesman has pronounced it the most important event from the Constitution to the civil war. Less than 10,000 patents precede it, more than 450,000 have followed in its train. Under it the Patent Office was established. Under it the first commissioner of patents was appointed, and hardly had the approving signature of Andrew Jackson been affixed before the walls of yonder Doric temple, already completed in design, began to rise. The most important change brought about by the act of 1836 was the restoration of the examination system and the establishment of an examining corps of experts. The English system, developed on executive lines, relegated all investigation to the courts; the American plan, developed on legislative lines, made the investigation precede the grant. The law of 1790 followed the American trend developed in the colonies, and Jefferson and his associates formed an examining board. Then came the act of 1793, which avowedly imitated the English system and permitted a patent to be issued to any one who should allege that he had made an invention, and should make oath that he believed himself to be the true inventor.

"The act of 1836 restored the American system. The Patent Office was vested with quasi-judicial as well as with executive functions, the patent being adjudicated upon in advance, and possessing, as soon as it was granted, the attributes of a patent, which, under the old system, had been tested by expensive litigation. The importance to inventors of the system of preliminary examination has been declared to be inestimable. It places at the service of the humblest inventor the services of trained experts in law and mechanics. It

makes the patent something more than an assertion of right, something more than a challenge to the world to show that the patentee was not the true inventor. It bears testimony that it has been compared with prior patents and publications, domestic and foreign, and with all that has been done in the United States, as far as known, and that the device or process claimed is what it professes to be—a new departure in the arts. Thus the patent acquires an immediate commercial value—a value which is enhanced just in proportion as means are supplied by the government for making an inquiry as complete and exhaustive as it is in human power to make it."

The speaker gave a brief sketch of John Ruggles, the Senator from Maine, the author of the act of 1836. The speaker referred to other laws since passed which had modified in some details the statute of 1836. In 1861 the term of a patent was extended from fourteen to seventeen years. In 1870 the laws were consolidated, and when the laws of the United States were revised in 1875, the act of 1870 was re-enacted without substantial change. All the statutes since the law of 1836 have been in substantial accord with the policy inaugurated by that act, and have had for their object to carry that policy into effect, with such modifications as experience has shown to be necessary. During 1790 three patents were granted; during 1890 the number was 26,292. In 1790 the receipts were about $15; in 1890 they were $1,340,372.60. In 1790 the work could only have required the infrequent services of a single clerk; and in 1890 the number of employes, including the examining, clerical and laboring force, was 590 men and women.

"The growth of the patent system," said the speaker, "has been brought about by the friendly laws which I have mentioned exercising their influence for the most part in four different channels.

"1. The patent system has stimulated inventive thought. Benjamin Franklin, a man of science, stood by the side of the old hand-lever printing press for a generation and left it where it was left three centuries before by Gutenberg. It remained for Hoe and other inventors who worked under the stimulus of the patent laws and patented their inventions to produce that marvelous machine for disseminating knowledge that has made the world a university. A century ago the apprentice learned the skill and secrets of his craft and jogged along contented with his acquirements. To-day no workman expects to leave his craft or calling without lifting it to a higher plane and providing it with better instrumentalities. A new power of achievement has come into human thinking. Men of all callings seem to have acquired the faculty, and no explanation of the change is even plausible which ignores the stimulating influence of a century of patent law.

"2. The patent system has stimulated men to transform their thinking into things. It is a long and toilsome road from the first fugitive suggestion through failure and discouragement and temporary defeat to an invention in a form perfected. If men were not induced by the rewards of a patent system to cling to their new ideas through all the vicissitudes of an inventor's experience, their hands would drop in discouragement. The story of the lost arts has never been told, even by Wendell Phillips, and decades and centuries of possible progress have been wrapped up in inventions which have dawned upon the human consciousness only to disappear and be forgotten.

"3. The patent system encourages men to disclose their inventions. The duty of men to disclose their discoveries is one which, if it exists at all, has never been recognized. It is not so, however, when patent laws prevail, and for a hundred years men have hastened to share with the public their newly acquired ideas, because of the invitation contained in the patent system, and the phenomenon of rediscovery is now a very rare experience.

"4. The patent system enables inventors to make their efforts fruitful and saves them from the folly of misdirected labor. The *Official Gazette* of the Patent Office publishes to the world the claims and one or more drawings of each patent. Each number of the *Gazette* may be likened to a series of maps, exhibiting that borderland adjacent to the illimitable unknown upon which the sun of human invention has shed its radiance while clocks and watches have registered a week of time. Inventors need not and do not, as formerly, delve in exhausted mines."

The speaker referred to the general unity of opinion that prevailed throughout the world in regard to the preservation of the patent system. The centennial exposition in this country contributed largely to this result. Instead of abolishing the patent laws in England, as had been advocated, in 1883 a new act vas passed upon a more liberal basis. Germany has revised its patent law. In all these changes, he said, the American system has been imitated.

In conclusion he said: "Let us hope that the United States, whose place in the vanguard of progress is so largely due to its great inventors, may not now through indifference to its patent system fall back in the procession of the nations. Let us hope that an aroused public sentiment, set in motion by this celebration of the achievements of a century, may demand for the patent system and for the office which administers its functions just recognition of its mighty influence and just provision for its needs as it enters upon the second century of its usefulness."

The Hon. Carroll D. Wright, Commissioner of Labor, then spoke on "The Relation of Invention to Labor," and said that the influence of inventions upon labor has been felt in two directions—economically and sociologically. The economical influence has also been in two ways, but diametrically opposite ways; first, in the displacement or contraction of labor, and, second, in the expansion of labor. Very many modern inventions have created employments where none existed before. In a sociological sense machinery has brought with it a new school of ethics. It is the type and representative of the civilization of this period because it embodies, so far as mechanics are concerned, the concentrated, clearly wrought-out thought of the age. Under the influence of inventions the workingman has learned that from a rude instrument of toil he has become an intelligent exponent of hidden laws; that he is not simply an animal wanting an animal's contentment, but is something more, and wants the contentment which belongs to the best environment.

The mistake should not be made of assigning the cause of strikes and controversies to retrogression or to supposed increasing antagonism or to any desire to destroy the grand results of past inventions. How a new system shall be established with perfect justice to capital and to labor, recognizing the moral forces at work contemporaneously with the industrial, and the perfectly just distribution of profits relative to the use of inventions, is the great problem of the age. Machinery is young—in fact, is only the forerunner of more golden deeds. That the workingman does not receive full justice as the result of the use of inventions must be the conclusion of every student.

The Hon. Justice Blatchford spoke especially to the legal side of the patent system, saying, in regard to the practice in England, that since the time of George III. it has been the uniform practice in England to grant letters patent to a person who introduces an invention not used before within the kingdom, and parliament has repeatedly recognized the principle by granting exclusive privileges to such introducers. James Watt's inventions tending to the perfection of the steam engine were followed by considerable litigation, resulting in numerous decisions straightening out and establishing patent law. Referring to present patent law abroad, the speaker said: "The statutes which now regulate the granting of patents in England are those of August 25, 1883, and December 24, 1888. It is not necessary that a person should be a British subject to apply for a patent. The application must state that the applicant is in possession of an invention of which he claims to be the true and first inventor. The word 'inventor' in these statutes covers an introducer.

"The acceptance of the complete specification is to be advertised, and any person may, within two months thereafter, give notice at the Patent Office that he opposes the grant of the patent on the ground that the applicant obtained the invention from him or from a person of whom he is the legal representative, or on the ground that the invention was patented in England on an application of prior date, or on the ground that the complete specification describes or claims an invention other than that described in the provisional specification, and that such other invention forms the subject of an application made by the opponent in the interval between the making of the two specifications. The patent is to be granted for fourteen years, but is to cease if certain fees are not paid within specified times.

"At least six months before the time limited for the expiration of the patent the patentee may apply for an extension, which may be granted on a favorable report from the judicial committee of the Privy Council for a further term not exceeding seven, or, in exceptional cases, fourteen years, and a patent may be vacated by a court on certain specified grounds."

The speaker then reviewed at some length the scope of the law in this country, and said that in the administration of the patent laws by the courts of the United States the proper rights of inventors have been firmly maintained, while the abuses which have crept in, in consequence of improper reissues of patents, have been corrected. Patents for important and meritorious inventions have been sustained, notably in the case of Morse's telegraph, which was held valid in the case of O'Reilly agt. Morse.

After outlining Morse's inventions and discoveries, Mr. Blatchford concluded his address in the following words: "The principle on which the patent laws are based is to give an inventor an exclusive right, for a limited time, in consideration of his fully disclosing his invention, so that it may be made and used by the public after the limited term shall have expired. Under this stimulus there has come into existence the brilliant succession of inventions which have contributed so greatly to the progress of science and the arts, and to the material welfare of nations and individuals. In this career our own country has played no small part, and it is quite certain that in the future American inventors will do their full share toward illustrating the beneficent operation of the patent laws, and that when, a hundred years hence, there shall be another centennial celebration like the one through which we are now passing, there will have occurred no diminution of the importance and value of American inventions."

Hon. Robert S. Taylor, speaking on the "Epoch-making Inventions of America," said that the real and enduring wealth of the world is its thoughts. It wants just a year of a century since there flashed across the mind of a young Georgia school teacher the thought that a machine could be made which would separate the cotton fiber from its seed by the action of saw teeth. With that thought dawned the epoch of cheap cotton cloth. Forty-six years later the sewing machine made its appearance to sew the cloth and inaugurate the epoch of cheap clothes. The two together gave the human body a new skin. Robert Fulton once said that the three men who had conferred most good on their fellows were Arkwright, Watt and Whitney. He was the fourth. He opened the epoch of steam travel. The railroad and the locomotive followed, like the evolution of birds from fishes, and the Chicago limited is the legitimate descendant from a paddle wheel steamboat. Since Franklin drew the first submissive spark from heaven, Americans have been foremost in the great field of electricity. The subjugation of this great force was begun when Prof. Morse taught it to talk. The steam engine is the breath and muscles, the telegraph the nervous system of the body politic. In the production of electric light, man has come nearer to creation than anywhere else. He has produced upon earth the light of the heavens—a true sunlight in fragments. But the most gratifying of all inventions is the telephone. It imparts a new function to speech and a new sense to the ear. The epoch of news came in with Hoe's cylinder press, and of cheap food with McCormick's reaper. There is no more beautiful invention than the typewriter—the sewing machine of thought, which clothes our ideas as that clothes our bodies. The patent system of the United States rests on twenty-two words in the Constitution. What other twenty-two words ever spoken or penned have borne such fruit of blessing to mankind?

The last speaker in the afternoon session of the first day was Senator Platt, of Connecticut, who is perhaps as widely known among inventors as any member of the national legislature. In his position as chairman of the Senate patent committee he has had a great deal to do with inventive designs. From the beginning he has been deeply interested in this celebration, and gave to the committee all the assistance in his power. He is a member of the advisory committee of the patent celebration. The Senator's theme was "Invention and Advancement," which he treated in the able and thoughtful style which characterizes all his public utterances.

At the evening session Senator John W. Daniel, of Virginia, spoke on "The New South as an Outgrowth of Invention and the American Patent Law." In the course of his remarks he said: "If I am asked the cause of the Northern victory in the late struggle, I look beyond the noise of battle to the Northern inventors, mechanics, and manufacturers." [Applause.] But, continued the Senator, the South applauded Northern genius and welcomed its results. The long list of great inventors from the South, however, proved that the South was no laggard in the race, while the fact that in 1890, 3,000 patents were granted to Southern men shows that the South will soon vie with the North in generous rivalry in every branch of invention. With a thoroughness that evidenced careful research Senator Daniel traced the part taken by the South in inventions of all kinds. Then he recounted the debt owed by the South to inventors, giving the highest place to Eli Whitney's cotton gin and Henry Bessemer's steel process. In describing how these inventions had aided the South to develop its resources, Senator Daniel spoke rapidly and with great eloquence, concluding with an impassioned eulogy of the inventor and with an expression of the hope that some day there would be erected in Washington a hall of sciences in which the achievements of American intellect could be displayed.

Assistant Secretary Willits, of the Department of Agriculture, whose remarks were extemporaneous, spoke of the dependence of the farmer on the product of the inventor.

At the afternoon session of the second day, A. R. Spofford, Librarian of Congress, read an elaborate paper on "The Copyright System of the United States," and was followed by Prof. Thomas Gray, of Indiana, with a paper on "The Inventors of the Telegraph and Telephone." Col. F. A. Seely, of Pennsylvania, Principal Examiner of the Patent Office, also spoke on "International Protection of Industrial Property." In the evening, S. P. Langley, the secretary of the Smithsonian Institution, presided, Secretary Noble occupying a seat on the platform. Professor

Langley spoke briefly of the progress of invention, particularly during the last ten years. Professor William P. Trowbridge, of Columbia College, New York, read a paper on "The Effect of Technical Schools upon the Progress of Invention." The next paper, entitled "The Invention of the Steam Engine," was by Professor Robert H. Thurston, the director and professor of mechanical engineering in Sibley College, Cornell University. The paper was an elaborate history of the steam engine from the time of its invention down to the present time. Captain Birnie, of the Ordnance Bureau, read a paper prepared by Major Clarence E. Dutton, U. S. A., on "The Influence of Invention upon the Implements and Munitions of Modern Warfare," and Professor F. W. Clarke, of Ohio, the chief chemist of the United States Geological Survey, read a paper on "The Relation of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics." It is impossible, in the space this week at our command, to give any adequate abstract of these valuable papers, the most interesting portions of which we shall endeavor to give in a future issue.

At the meeting on the evening of April 10, Prof. Alexander Graham Bell presided, and the following papers were read: By William T. Harris, United States Commissioner of Education, on "The Relation of Invention to the Communication of Intelligence and the Diffusion of Knowledge by Newspaper and Book;" by Professor Otis T. Mason, of Virginia, the curator of the National Museum, on "The Birth of Invention;" and by Dr. John S. Billings, curator of the Army Medical Museum, on "The American Inventions and Discoveries in Medicine, Surgery, and Practical Sanitation."

Among the views forming a portion of our first page illustration are representations of a number of curiosities in the way of models and machines, which have been collected and placed on exhibition in the lecture hall of the National Museum. One of these is the identical press at which Benjamin Franklin worked in London. Another represents the water clock, one of the oldest and clumsiest of time pieces, in connection with which is shown a modern chronoscope, measuring time to the five-hundredths of a second. The first life-saving car made by Joseph Francis is also shown, and a model of the plow used by Prof. Morse in laying the first telegraph line. An original model of Davenport's electric motor and circular railway dates back to 1837, and another exhibit is that of the cylinder of the Stourbridge Lion, one of the first locomotives built for traffic in the United States.

Our portrait of President Harrison is from a recent photograph by Charles Parker, 477 Pennsylvania Avenue, Washington.

At the special reception to inventors and manufacturers in the rotunda of the Patent Office on Wednesday evening, there was a large and brilliant gathering. All was ablaze with light and color where the receiving party stood, rich hangings, festoons of flags and diadems, and other forms of incandescent lights contributing to the effect.

During the progress of the congress several meetings were held looking to the organization of a permanent National Association of Inventors and Manufacturers of patented articles, to secure co-operation in matters tending to the improvement of the patent system, that "organized effort may be made to remedy existing defects and provide against danger in the future." On the evening of April 10 such an organization was completed, and a constitution and by-laws adopted. Dr. Gatling, the inventor of the Gatling gun, was chosen president, and Gardner R. Hubbard, of Washington; Professor William A. Anthony, president of the American Institute of Electrical Engineers; Thomas Shaw, of Philadelphia, and Benjamin Butterworth, of Ohio, were elected vice-presidents.

Sensitive Galvanometer.

At a recent meeting of the Royal Scottish Society of Arts at Edinburgh, Dr. R. Milne Murray described and exhibited a reflecting galvanometer for physiological work. The instrument was an astatic galvanometer of the Thomson type, with special modifications. One of these was that the mirror was placed between the two systems of needles, instead of being attached to the upper system. But the principal modification was the mode of damping adopted so as to secure aperiodicity. The filament which carried the needles and the mirror had attached to its lower end a light vane, spade-shaped, which just dipped into an adjustable cup of oil, so that when the needles were deflected, the capillary attraction of the oil from the vane brought the system readily to a standstill. Dr. Murray claimed for his galvanometer great sensitivity, a high figure of merit, and a remarkable degree of aperiodicity.

THE electric street cars which for the past year have been run on the Fourth Avenue street railway, this city, and which were propelled by storage batteries carried on the cars, have been withdrawn. Reason, litigation over the patents.

Correspondence.

Life Saving Telephones—A Good Suggestion.

To the Editor of the Scientific American:

I read with much interest the article in the SCIENTIFIC AMERICAN of February 21, about the United States life saving service, and it was a surprise to me to see that the surfman, patrolling the shore, not having better means by which to communicate with his station. If I understand the article right, he will have to run to the nearest station as soon as he sees a wreck, and report, which necessarily will take more or less time, and may mean many lives lost. That mode of operating seems to me to be crude and old fashioned and ought to be dispensed with, and in its place should be erected a telephone line, running close to the shore, with one or more patrol boxes, furnished with telephones, through which the watchman could report. Such a line would not necessarily be very expensive. A one wire system I think would be sufficient, supported on short poles. The life saving crew could be instructed how to keep the line in repair and one of the telephone companies ought to supply the instruments, free of charge, or at least at a nominal price, considering the humane purpose for which it is to be used. We see how well the signal system works in our large cities. How many millions of dollars' worth of property and how many lives have been saved by the fire alarm system, and likewise how efficient has the police alarm system shown itself to be, and I can see no reason why the same system couldn't be adopted on our life saving service. If this idea is new, I would like you to publish it. If not, throw it in the waste basket.

A. LARSEN.

27 Hastings Street, Chicago, Ill.

How to Cut Glass by Means of Heat.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of March 28, under Notes and Queries, I notice that J. B. V. asks how to cut a bottle off near the bottom without destroying the remainder. The answer given is: "File a notch, start a crack with a red hot poker, and lead it around." In "Experimental Science," by Geo. M. Hopkins, I notice a similar method, the only difference being that the author recommends giving the bottle a rotary motion inside a wire curved similarly to the bottle.

It may be due to my awkward manipulation, but I have never been able to obtain very satisfactory results with either method. If I make use of an iron sufficiently large and long to hold the heat well, I cannot guide it where I wish. If I make the iron smaller and shorter, so as to control its movements better, I either burn my hand or the iron is so small that it soon loses its effective power in producing unequal expansion, and requires very frequent heating.

To those of your readers who can produce good results with a hot poker I have nothing to say; but to those who, like myself, are unable to satisfactorily make use of the hot iron, I have a method to suggest that is simple, and with me has given very desirable results.

If a piece of quarter inch soft glass tubing be drawn out so that the bore be somewhat less than one-half a millimeter in diameter, and then attached, by means of the large end inserted into a piece of rubber tubing, to a gas spigot, a small flame, about one and one-half centimeters long and two or three millimeters in diameter, can be produced. By holding the piece of glass tubing as one would a lead pencil, with the point of the flame applied to the file scratch or an already started crack, one can lead a crack, not by long, irregular jumps, but gradually and accurately, in any direction he may desire.

This device, though very simple, has given me most excellent results, not only in cutting bottles and large glass tubes, but in cutting plate glass when a diamond cutter was available. I have found that a pointed flame, formed with a small opening and under the ordinary pressure of the gas, works better than a shorter and thicker flame, formed with a larger opening and with less pressure. The flame in the one case will be almost in the same plane with the tubing, if the glass tube be held horizontally or as a pencil would naturally hang in the hand, and its point can be applied at any angle. In the case of the flame formed from the larger opening, and with the gas pressure partially cut off, the flame will curve upward, and its point is with difficulty applied at most angles.

GEO. M. TURNER.

Auburn, N. Y.

Wooden vs. Metallic Ties.

To the Editor of the Scientific American:

In SUPPLEMENT, No. 789, February 14, 1891, in the article on "Preservative Treatment of Timber," the author draws a comparison between the expense of wood and metal ties, but omits several important factors. He proposes to treat the cheaper woods and increase the life, but overlooks entirely the fact that the wood which he considers, hemlock, or any other soft wood, will *wear* out before it rots, when not treated. It will not hold the spikes or support the rail for heavy traffic, as the rail works its way right down through it. He puts the price of oak ties at 70 cents, and the spikes cost 2½ cents per pound, and it takes 2 pounds per tie, and the spikes have to be renewed once during the life of the tie, making 10 cents for each tie.

With the large hewed Virginia ties of all thicknesses and widths it takes a day's work to remove, replace, spike, and properly tamp from seven to ten ties with slag ballast. A section boss here has, on the average, four men at $1.15 per day, and to this must be added 44 cents (one-fourth boss' wages), making $1.59, which at ten ties per day is .159 per tie.

Cost of tie in road .70 + .10 + .159 + .041 (second spiking) = $1.00. Many actually cost more, to say nothing of driving *all* spikes down in the spring, etc.

The writer fixes the life at 7 years. The dollar is to be lost in 7 years, or .143, nearly, per year, to which must be added interest at 5 per cent, making a yearly expense of .193 for the best ties; while for cheaper ones it is more.

Wood ties vary in thickness, and the water settles under these thick ones, causing the unpleasant act of "pumping," which makes the thickest tie the poorest support.

The steel tie is worth for scrap about one-third of cost, but we will count it as only paying for changing the tie and interest on cost of change. We received the estimate of some of the Mahoning Valley iron workers and rolling mill managers, and they estimate a tie of angle steel plate, with rail fastenings of a certain pattern taken as a basis, at 120 pounds, at a cost of $2.00.

Counting the life of the tie at 40 years (iron men say it will last longer) it would be a loss of 5 cents per year, to which must be added 10 cents interest, making 15 cents as the actual yearly cost of each tie. To those who think that 40 years is too long an estimate, we will say that it proves cheaper with a life of only 22½ years, as will be seen by division, making the yearly loss .0889 + .10, or .1889.

The figures given were obtained from railroad men.

F. F. MAIN.

Bristolville, Ohio, April 5, 1891.

An American Blast Furnace in England.

The new furnace which Palmer's Shipbuilding and Iron Company, limited, have put up at Jarrow-on-Tyne is virtually an American one, as regards its lines and method of working. It will, says *Engineering*, afford manufacturers evidence as to whether the American or Cleveland blast furnace practice is the more economical and satisfactory for the British producer, and thus its working will be looked upon with more than ordinary interest, as there is much controversy on the point in question. The furnace is an exact copy of the most recent one at the Edgar Thomson Works of Messrs. Carnegie Brothers, at Pittsburg—a furnace which has produced up to 2,500 tons per week of pig iron, which is more than double the output of our best hematite furnaces, nearly five times as much as an ordinary Cleveland furnace, and almost twelve times that of the average Scotch furnace. The new Jarrow furnace is 76 ft. 2 in. in height with a 20 ft. bosh and 11 ft. depth of well. It has four Cowper hot blast firebrick stoves, and is blown by a compound condensing engine having 100 in. blowing cylinders. In America it is not the practice to have one blowing engine to several furnaces as it is in England, but each furnace has its separate engine, and this will be the case with this new furnace. There are eight tuyeres made of bronze, the use of that metal for such a purpose being peculiar to America, and has till now not been adopted in our own country. The blast will be driven into the furnace at a pressure of about 8 lb. per square inch, in the United States the pressure is nearly 10 lb., whereas in Cleveland it is only 5 lb. to 5¼ lb. On this account the furnace must be expected to produce a good deal more iron in a given time than the ordinary British hematite furnace, for it is to be fed with hematite ore, but it will not come up to the largest records in the United States, seeing it will have to smelt a 50 per cent ore, whereas in America they use a 60 to 63 per cent ore, which is moreover much less refractory than the Spanish ore generally used here. When blowing at such a pressure something, of course, has to be done to preserve the brickwork from the extra heat, and the furnace is, therefore, encircled by rings of water tubing 64 in number, through which some 1,500 gallons of water circulate per minute.

Palladium Plating.

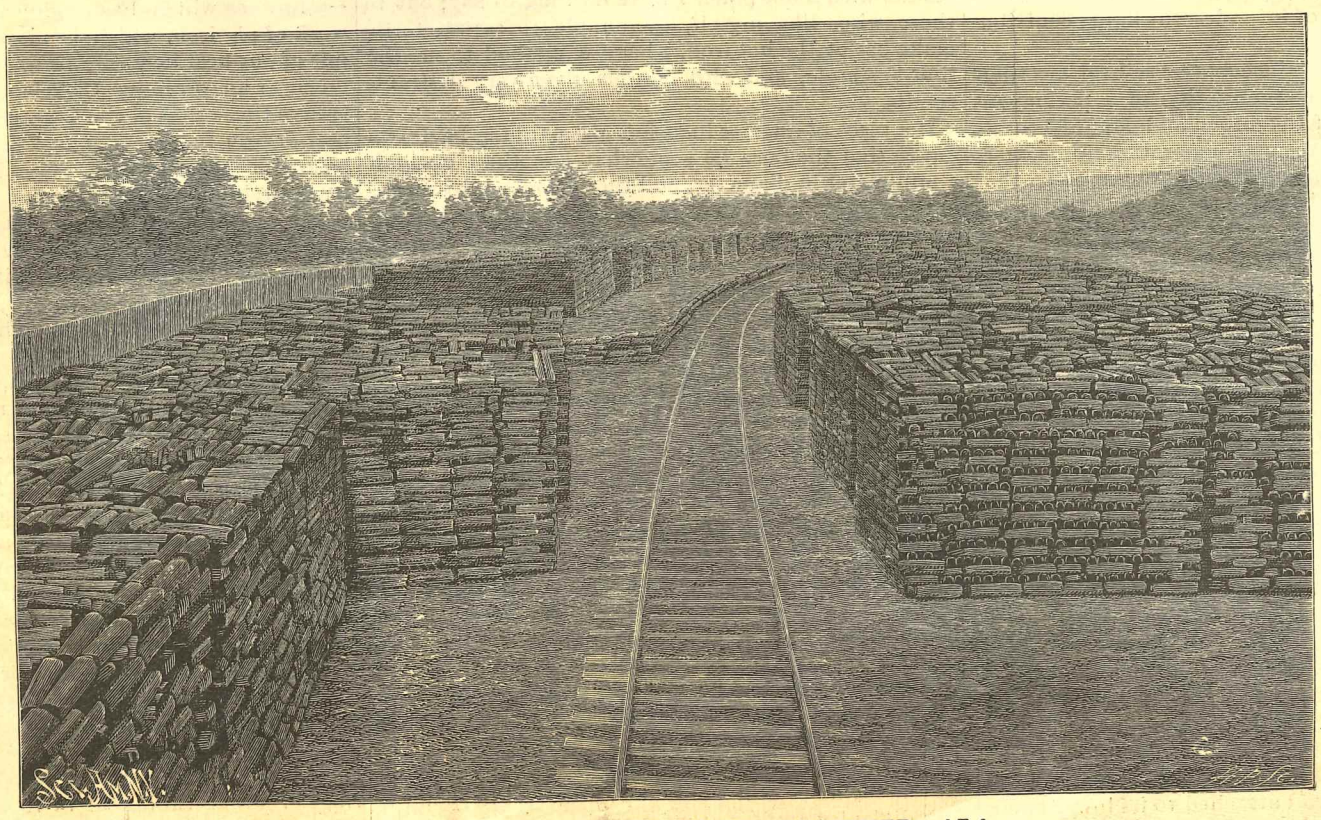
Palladium, which is a whiter, lighter, and more fusible metal than platinum, has of recent years been much used to plate watch movements, says the *Electrician*. According to M. Pilet, four milligrammes (about one-seventeenth of a grain) of palladium is sufficient to coat the works of an ordinary sized watch. M. Pilet recommends the following bath: Water, 2 liters; chloride of palladium, 10 grammes; phosphate of ammonia, 100 grammes; phosphate of soda, 500 grammes; benzoic acid, 5 grammes. This bath is suitable for all metals except zinc.

Education at the World's Fair.

Commissioner Harris is desirous that a single building be furnished at the Columbian Exposition, Chicago, of sufficient extent to contain and properly display all of the exhibits that belong to education. He says that at Philadelphia in 1876 not only the foreign exhibits were separated and scattered, but the exhibits of the several States were isolated from one another. The effect of the educational exhibit at Philadelphia consequently was very much weakened. But at the cotton centennial at New Orleans, the educational exhibits of the United States and of foreign nations, with a few exceptions, were brought together in the gallery of the government building. Those who inspected it pronounce it the best exhibit hitherto made of education. Undoubtedly it derived half its advantage from the fact that it was disposed and arranged under one supervision, and the whole of its material brought together in one place. Dr. Harris suggests there be organized in each State, as soon as possible, a committee with authority to take in charge all matters pertaining to educational exhibits. Such a committee may be provided for by the legislature, or appointed by the governor, or, in the event that neither of these arrangements is practicable, said committee may be organized by election from local committees formed in cities and towns, and in the educational institutions of the State. In whatever manner appointed, the committee should be thoroughly representative of all classes of schools and educational institutions, whether public, private, or denominational, and it should include State, county, and city superintendents, the officers of private schools and academies, presidents of colleges and universities, directors of institutions for the defective classes, etc. This proposition is most sensible, and should meet with a hearty response from all who wish to see our educational interests properly presented at this great exposition. Representatives from all the world will visit this great exhibit, and it is highly important that they should see what we are doing toward educating our children and youth.—*New York School Journal.*

HOW STOCKS OF PIG IRON ARE HELD.

Within the past two or three years there has grown up in this country a system, which had previously been successfully adopted in Scotland and England, by which the products of pig iron furnaces may be conveniently stored, when the demand for consumption is light, and the owners can obtain money thereon, proportionate to the value of the accumulating product, with which to keep their furnaces in operation during a dull season. This system as carried out by the American Pig Iron Storage Warrant Company includes the establishment of what is known as a "warrant" yard in close proximity to each large furnace, and convenient to the necessary transportation facilities. These yards are owned or leased by the company, and in charge of its special agent. When the production of the furnace is in excess of its sales, or the owners desire to hold the product for an anticipated better market in the future, such a yard not only affords a convenient storage place, but the iron, as received there, is inspected by an expert agent, and a warrant is issued for each lot, certifying its quantity and grade. These certificates, representing each so much iron of a defined quality, are readily negotiable in all the principal markets, after the same manner as the pipe line certificates representing petroleum, or any species of stocks or bonds. The owner, on pledge of such security, can borrow money at the most advantageous rates, and the certificates themselves are salable by transfer as so much iron.

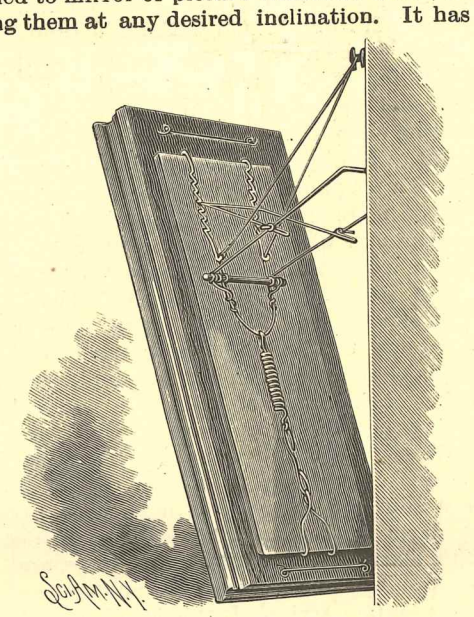


A PIG IRON STORAGE YARD, BESSEMER, ALA.

In the accompanying illustration we present a view, made from a photograph, of such a storage yard at Bessemer, Ala., containing over 12,000 tons of pig iron. The yard is about 120 feet wide and 600 feet long, and each 100 tons is piled in a solid block, forming a pile about twelve feet long, ten feet wide, and eight feet high, each block being well defined and plainly marked. The company has about twenty of these yards established at different furnaces in Virginia, West Virginia, Kentucky, Tennessee, Georgia, and Alabama, and other places. There was on storage at all of these yards, on April 1, about 55,000 tons, but the quantity was being reduced, as more iron was being taken out for consumption than was coming in from the furnaces.

A HANGER FOR PICTURE OR MIRROR FRAMES.

The illustration represents the application of a convenient and inexpensive device that may be quickly attached to mirror or picture frames of different sizes, to hang them at any desired inclination. It has been



RULON'S PICTURE FRAME HANGER.

patented by Mr. David G. Rulon, of No. 826 South Main Street, Monmouth, Ill. The wire suspending portion of the device extending across the back of the frame is coiled around a horizontal stay rod, and has a series of short return bends on the two limbs above the stay rod, forming ratchet racks, while a spiral spring forms a section of its length below the stay rod. Upon the end portions of the stay bar are wrapped the ends of a wire prop piece having ring eyes in its side members, such eyes being loosely engaged by the ends of a wire brace adapted to engage the teeth of the ratchet racks, thus holding the prop piece inclined outwardly from the frame as desired to give the proper inclination to the picture or mirror to which the device is applied. The frame is suspended by means of a strand of wire connected to eyes on the side limbs of the hanger, and when there are no ledges on the back of the frame with which to connect the device, short holder wire strips are secured in proper position near the top and bottom of the frame, with which the hooks at the ends of the hanger are brought into engagement.

IT is sometimes convenient for an engineer to be able to approximate the amount of condensation that will take place in pipes during a certain length of time. From many experiments made on the condensation of steam in wrought iron pipes when exposed to the open air, it is found that 1 pound and 6 ounces of steam per square foot of pipe's surface was condensed per hour when the difference in temperature between the steam and air amounted to 200°. As this is very nearly the difference of temperature usually found between the steam in the pipes and the air on the outside, this simple rule will give results sufficiently close for ordinary purposes.

What May be Patented.

The Washington *Chronicle* gives the gist of our patent laws in the fewest possible words as follows:

A United States patent will be granted to any person who has invented or discovered any new and useful art, machine, manufacture, or improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any other country, before his discovery or invention thereof, and not in public use nor on sale for more than two years prior to his application, unless the same is proved to have been abandoned.

In this connection the word "art" means the process or method of producing an old or new result. If a method of doing anything contains one or more new steps, the process is new and patentable.

The word "machine" means any device or thing by means of which a mechanical result may be produced, such as a pin, a churn, or a locomotive.

The word "manufacture" means a made-up article, such as furniture, clothing, harness, and the thousands of things which are offered for sale.

"Composition of matter" means a chemical compound of ingredients, such as hard rubber, liquid glue, medicine, etc.

Patents may also be obtained for designs for manufactures and works of art, for three, seven, and ten years.

Trade marks may be registered for any arbitrary sign or symbol which is not descriptive; the government fee is $25. Such marks are the exclusive property of the registrar for thirty years, and the time may be extended.

A "label" is any descriptive tag, print, or impression to be placed upon any article or its case, and it may be registered for twenty-eight years. The government fee for a "label" is $6; but if it contains any special mark or symbol, the office decides it to be a "trade mark" instead of a label.

Heavy Locomotives for the St. Clair Tunnel.

The approaches of the St. Clair Tunnel, connecting the Grand Trunk Railway of Canada with its line in Michigan, will have a grade of 105 feet to the mile, and a very heavy locomotive will, consequently, be required to haul heavy trains up the grade. For this purpose four extra large locomotives are being built by the Baldwin Locomotive Works, the heaviest ever built there, and, it is believed, the largest ever built in America. One of them, "No. 598," is already completed, is now at Port Huron, and in working order weighs 195,000 pounds. These locomotives are of the class known as tank locomotives, and have no tender. The tanks are on both sides of the boiler, and their capacity is 2,000 gallons. The space for the fuel, which is anthracite coal, is on the foot-board. There are five pairs of driving wheels, which are the only wheels, and they are 50 inches in diameter. The wheel base is 18 feet 3 inches. The cylinders are 22 inches in diameter and have a stroke of 28 inches. The boiler is of steel, 5/8 of an inch thick, and is 6 feet 2 inches in diameter. There are 280 flues, 2¼ inches in diameter and 13 feet 6 inches long. The firebox is 11 feet long and 3½ feet wide. The cab is placed on top of the boiler and midway between the ends. There are two sand boxes, one on the front of the boiler and one on the back, so that sand can be placed on the rails whether the locomotive is running forward or backward. There is a powerful air brake which operates on each driving wheel. There are headlights and steps at both ends, like those of a shifting engine. The locomotive will run on 100 pound rails. In its completed state the locomotive is too heavy for some of the bridges it will have to cross *en route* from the Philadelphia shops to the tunnel, so the cab, the tanks, side rods, and other parts will have to be taken off to lighten her weight and be shipped separately.

ONE of the features of the grand parade in Des Moines during the Iowa state fair was an electrically propelled buggy, the current being furnished by storage batteries.

IMPROVED CLOTH PRESSING MACHINE.

We give illustrations of Nusseys & Leachman's cloth pressing machine, made by Messrs. W. B. Leachman & Co., of Leeds, and described by *Engineering* as follows:

Fig. 1 is a general view, Fig. 2 is a sectional elevation of the motive part of the machine, and Fig. 3 a section through the pressing part.

The apparatus, it will be seen, is a combined steam and hydraulic arrangement. The cloth to be operated upon is passed through heater plates, which rise and fall to give the required pressure, and is wound on the rollers seen above the machine. It will be evident that the winding on the rollers cannot proceed while the cloth is being pressed between the plates, and an intermittent action is, therefore, required. The pressing and winding operations are automatic, so that the cloth is transferred from the rolls, on which it comes in unpressed, to those on the machine, without any labor being required beyond stitching the lengths together, and one man and a boy are sufficient to look after the machine.

This is a great advantage for the manufacturer, as there has been in some districts a good deal of trouble with the men who have been employed, under the usual system, in lifting the cloth in and out of the old presses. These operatives have been well organized, and have laid down very stringent regulations as to the size and weight of pieces of cloth that should be handled, they refusing to deal with larger pieces, no matter what the rate of pay might be or how many men might be allowed to the job. Messrs. Leachman's machine has got over this difficulty, and men have no longer to complain that they are asked to handle pieces of cloth larger than they fancy. Like most benefactors of their kind, however, Messrs. Leachman received at first small thanks; indeed, for some time the post bag of the firm was largely taken up with letters containing threats to "do for" the principal, unless he stopped making these—in the letters—strongly adjectived machines.

Referring to Fig. 2, A is the steam cylinder, taking steam only on the lower side of the piston, by means of a slide valve, which is worked by the lever, B, in turn actuated by the cam, C. The hydraulic pump, P, is thus worked. When steam is being admitted the runner, E, is clear of the cam at the point, F, so that the weight, G, can press the valve on to the valve face at H, leaving a free passage from the pump, P, into the pipe, I, and closing the pipe, Q. For lifting the pressing plates there is a compound ram, a smaller one within a larger. The former is sufficiently powerful to bring the large ram and the plates up to the work, at which time the full power is put on to give the pressure required to treat the cloth. The pipe, Q, previously referred to, leads to the larger ram, and the branch, I, to the smaller ram. As the larger ram is being lifted (during the first part of its upward stroke) by the smaller ram it is necessary to fill the space it leaves in its cylinder, and this is done by means of the valve, M, which opens communication between an elevated tank and the big cylinder. The cam continues its revolution until the elevation, O, comes in contact with the runner, E, which is pressed upward, and thus, by means of the valve, H, opens communication between the hydraulic pump cylinder and the pipe, Q, leading to the large ram; at the same time the valve, M, is closed by the superiority of pressure in the pump over that due to the elevation of the tank. It is at this time that the full pressure is exerted on the cloth. During these operations the full pressure has been admitted to the steam cylinder, but the cam now opens the exhaust by means of the lever, B. The cam arrangement is best shown by the perspective view.

Fig. 2

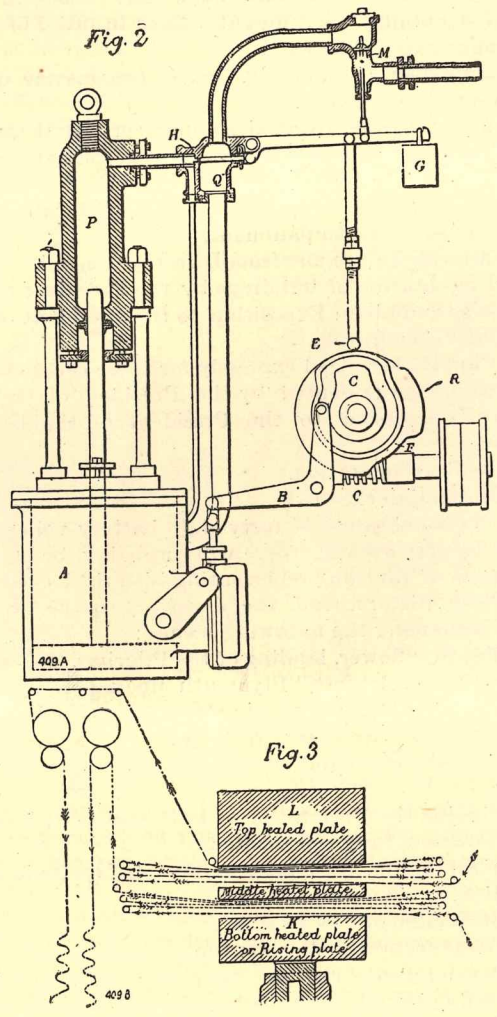


Fig. 3

It is now necessary to release the water pressure, so as to let the presser plates fall, and allow the winding of the cloth on the rollers to proceed. This is effected by means of the projection, R, on the cam. This lifts the runner, E, and by means of the spindle shown raises the valve, M, thus opening an exhaust passage. The mechanism by which the cloth is wound on the rollers and is thus drawn through the press is very simple. There is a stop on the bottom heater plate, K, Fig. 3, which sets the actuating gear at work and throws it out of action intermittently, so as to synchronize with the pressing and releasing of the cloth between the plates.

The small rollers over which the cloth is led backward and forward through the press are shown in Fig. 1, and diagrammatically in Fig. 3. These rollers are actuated by gearing, one pinion of which is seen in Fig. 1. In our perspective view no cloth is shown in the press, but there were some sheets of paper between the

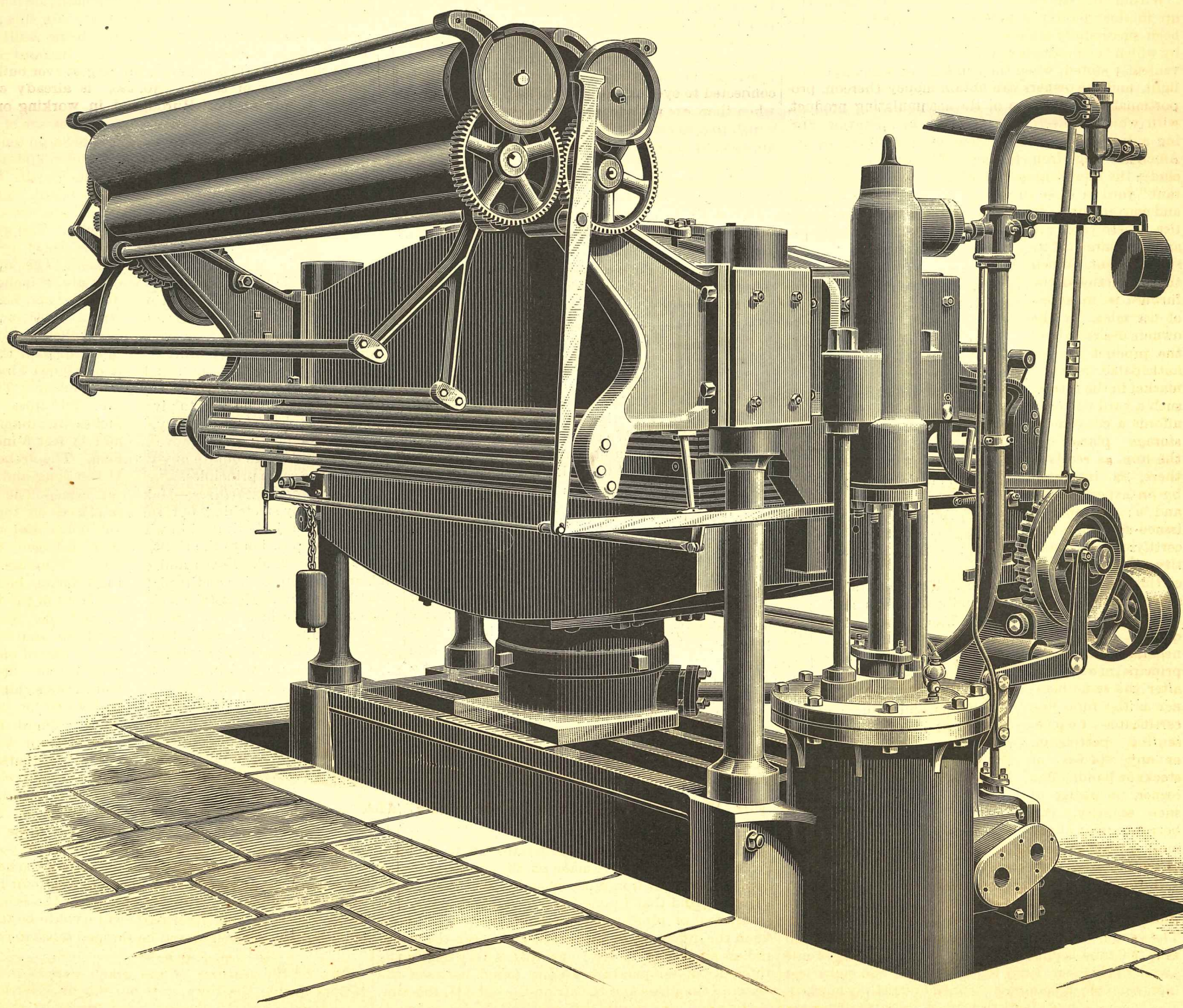


Fig. 1.—IMPROVED CLOTH PRESSING MACHINE.

plates when the photograph from which our illustration has been made was taken. These have been reproduced by the engraver. A pressure of 350 to 500 tons is put on at every stroke and the cloth is drawn the width of the plate each stroke, and receives five nips in all. Two pieces can be done at once, as shown by Fig. 3, the rate being 480 yards per hour of wide width, or double that length of narrow widths.

There are now over fifty of these machines at work, many of them being supplied to some of the largest mills in this country and on the Continent. The makers claim a saving of one-half in the original cost of the machine compared to one of the older type producing the same amount of work. The saving of space is also said to be considerable. One machine requires a space 18 feet by 14 feet, whereas the older presses producing the same amount of work would take up four times that room.

Plans for the Dedication of the Columbian Fair, October, 1892.

There will be some novel sights in Chicago, October 12, 1892, if the plans of the World's Fair Committee on Ceremonies be carried out. October 12 is the day set apart by Congress for dedicating the great buildings in Jackson Park, and the Ceremonies Committee has provided for oratory, music, a military review, tableaux illustrating the life of Columbus from a boy to a discoverer, the landing of the Pilgrims, the burning of Chicago, and a civic and industrial parade. There will be fireworks along the lake shore, the booming of cannons, and there will be present, if the plans be carried out, distinguished foreign potentates and citizens, the President of the United States and his Cabinet, the Governors of all the States, and other great men of the nation.

To carry out these ceremonies the directory has appropriated $150,000, and a programme has been prepared by the Joint Committee on Ceremonies. The programme covers four days, beginning Tuesday, October 11. It is reported by the committee as follows:

The committee decided to invite 10,000 troops, proportioned among the States and comprising the flower of the National Guard of the United States, to participate in the dedication ceremonies. In addition to the National Guard the government will order several regiments and batteries to report here at the same time.

FIRST DAY.

The grand parade of troops will take place Tuesday through the principal streets of Chicago and will end at Jackson Park, where the encampment will be held.

Tuesday evening it is proposed to give a series of tableaux representing salient historical facts in the life of Columbus, of which the following is a brief description:

1. Columbus as a boy, in his humble home in Genoa.
2. Columbus in Lisbon, awaiting the tardy action of King John II.
3. The dream of Columbus. He has fallen asleep over his work and sees in his dream the fulfillment of his own ambition. The panorama moves, showing an unknown ocean; a beautiful tropical land appears; birth of a new empire.
4. Columbus before King John II., who refers him to the Council on Geographical Affairs.
5. Columbus before the council.
6. Columbus at the court of Ferdinand and Isabella at Cordova.
7. Columbus before the council at Salamanca in September, 1486, representing a room in the Convent of St. Stephen's.
8. Columbus before the gate of the little convent on the hill with his young son.
9. Small room in same convent. A painting on the wall representing the world as it was known at the time. Columbus explaining to the friar his grand idea.
10. Columbus departs for France. The Mountain of Elvira and Bridge of Pines. Columbus and his mule. Stopped by the Queen's courier. The message from heaven.
11. Departure from Palos, Aug. 3, 1492. Three caravels preparing to sail.
12. Night scene, time 10 p. m., Oct. 11, 1492. The Santa Maria, full rigged. Columbus and figures of sailors seen upon the deck. A distant light, to which Columbus is directing attention.
13. Landing of Columbus, the morning of Oct. 12, 1492. San Salvador. Planting the standard of Spain. Tropical scenery. Natives looking upon the scene with fear and awe.
14. The Court of Barcelona. Ferdinand and Isabella give a royal welcome to the great discoverer, who presents them with a new kingdom. Natives, strange woods, flowers, etc., from the new world.

SECOND DAY.

Wednesday, Oct. 12, will be the main day of the dedication ceremonies, and will be ushered in by a national salute of forty-eight battery volleys fired by all batteries in attendance. At 10 o'clock a. m. the troops will be formed and escort the President of the United States, the diplomatic corps, and distinguished foreigners to the main building. Upon the arrival of the President the consolidated bands will play "America." The entrance of the thirteen original States will take place with appropriate ceremonies—banners emblazoned with the coat of arms, the States represented by their governors, uniformed staffs, etc. Then in reasonable rapidity the different States in order of their entrance into the Union.

The following or a nearly similar programme of exercises will take place:

1. Music, "Star-spangled Banner" or "Hail Columbia," with full chorus and orchestral accompaniment.
2. Prayer.
3. Commemoration ode set to music, with full chorus and orchestral accompaniment.
4. Address and report from Director-General.
5. Presentation of buildings by the President of the World's Columbian Exposition to the President of the National Commission.
6. Cantata arranged expressly for these ceremonies.
7. Buildings presented by the President of the National Commission to the President of the United States.
8. Dedication oration.
9. Hallelujah chorus.
10. National salute of forty-eight battery volleys.

Wednesday evening there will probably be a continuation of tableaux representing historical events in American history, from the discovery to the present time, embracing the following scenes:

1. The Mayflower, landing of the Pilgrims, the "stern and rock-bound coast," Plymouth Rock.
2. Group of Pilgrims making treaty with the Indians. Miles Standish, Brewster, Winslow.
3. William Penn and his associates; historical tableaux.
4. Signing the Declaration of Independence; historical characters fully represented.
5. Washington, Rochambeau, and Lafayette in consultation.
6. Surrender of Cornwallis.
7. Inauguration of Washington.
8. Development—Fulton's boat, Cunarder, matches, electrical appliances, railroads and bridges.
9. Discovery of gold mining. Camp.
10. "Westward the Star of Empire takes its Course."
11. War.
12. Emancipation.
13. Peace—Allegory.

11, 12 and 13 to be arranged in grand transformation scenes.

14. Burning of Chicago; grand transformation scene; rebuilding; World's Fair.

THIRD AND FOURTH DAYS.

Thursday there will be a mammoth civic and industrial procession, which will fully illustrate all departments of industry. It is expected to arrange floats on platform cars and move them over the cable lines of the city to Jackson Park. The evening will be devoted to fireworks in all the parks and upon the lake along the entire front of the city.

Electricity in Tooth Extraction.

A small party of medical men and dentists lately met at the Institute of Medical Electricity, 35 Fitzroy Square, W. C., London, to witness a demonstration of the new method of extracting teeth without pain. One of our staff was there. We sent the one who has most experience in the shocks and squirms of the dentist's chair, and he was imbued when he left the office with more than his share of skepticism regarding the powers of electricity in drawing teeth. He came back brimming full of enthusiasm about the "vibrator." This is what the electrical arrangement is called. It is a simple arrangement, consisting of a neat walnut case, within which are a couple of bichromate cells and a Ruhmkorff's coil to which is attached a commutator of extreme sensitiveness. The commutator is the secret of the whole affair. It is a thin ribbon of highly tempered metal, secured at each end by an elaborate arrangement of screws. It is capable of vibrating at a tremendous pace—so quickly, indeed, that it is really musical—and the force passing through the coil is regulated until the vibrator is in unison with the key A, which the Philharmonic Society says is equal to 420 vibrations per second.

The operator was Mr. Burgoyne Pillin, L.D.S., who stated that he was a visitor himself, not being connected with the institute. He had four patients in waiting. The first was a young professional man, who seated himself in the operating chair to get a bicuspid extracted. He got the handles of the battery in his hands. One of these is connected with the negative pole. The positive is divided into two, so that one of the divisions is connected with the handle and a wire from the other division is screwed into the handle of the tooth forceps. When the patient takes hold of the handles the current is gradually increased in intensity until the patient can bear no more; then, while the forceps are being introduced, the current is turned off for a second, and on again. The rest is the same as without electricity. "Had you no pain?" asked our representative of the patient when the roots of the bicuspid were held up to view. "Not a bit; I only felt the grip." "What did you mean by stretching your body, then?" "Oh, that was when the current was turned on." "You didn't feel the frightful wrench, then?" "No," was the reply. Our representative was still skeptical, it will be seen. All this skepticism went with the next patient, a young and robust-looking lady, who had the left anterior upper molar troubling her. She took the chair, and quickly enough Mr. Pillin had his forceps on the shell. Crack it went, and the usual thing followed—three separate extractions, the last bringing away part of the crown and two twisted roots an inch in length—as bad a case as one could wish to see. It took some time to persuade the patient that her tooth was out. "I felt no pain," she said, after she had an affirmative reply to her question, "Is it out?" The next patient was a young lad who declared that he felt like getting a shave (he had not got his first). His lower bicuspid was also quickly brought to view, and he went out with a smile.

The next turned out to be a bad case. The tooth was fearfully exostosed, and it was only by a prolonged wrench, which was painful to look upon, that Mr. Pillin got it out; but the patient showed not a trace of pain, and he, like the others before him, was quite free from shock. This is one of the characteristics of the process: there is no nervous shock.

The four cases were typical, and all the experts present were enthusiastic about the success, and loud in their praises of Mr. Pillin's skill. Now, why is it that electricity prevents pain? was the question that every one was asking. Simple enough, said Dr. Arthur Harries, the physician to the institute. "Electricity travels over the nerve at the rate of 420 vibrations per second; pain travels from the tooth to the brain in one-sixtieth of a second. My theory is that the electricity, being so much quicker and having the greatest force behind it, gets to the brain first, and then keeps the line for itself, crowding out the pain." If Dr. Harries' theory is right, what a future there is for electricity in surgery! Chloroform and all other anæsthetics will have to take a back seat, and we shall banish pain simply by not allowing it to be produced.

There are other points about the vibrator which we should like to speak of, but need only mention that there is less bleeding and that it interferes in no way with the operator. It is really a good thing, thoroughly sound in principle, and without any humbug about it. —*Chemist and Druggist.*

Ghost or Shadow Pictures in Photography and the Twin Brothers.

To the majority of amateur photographers the camera is mainly an instrument by which they can make the likeness of a friend or copy a landscape; but few are aware of the entertaining and amusing results that may be obtained apart from the ordinary routine.

One very striking picture that may be made is a man seated at a table writing, and his own ghost—through which the objects of the room may be faintly seen—standing behind his chair. Or a man starting back in terror from his own ghost, or even a pair of them.

Another very amusing picture—which I call the twin brothers—is two or three perfect busts or figures side by side, but both or all three the same persons. It would take too much space to give a thorough description of this style of photography, but I will here give directions for making the above mentioned pictures, and the operator can obtain any variety he chooses by following the same principles.

Ghost or Shadow Pictures.—Make a background the required size by stretching out some black material. Place your subject—draped in white or light colored clothing—in position to the right or left of the center of the background. Focus and expose for half a second, and the impression on the plate will be a shadowy, ghost-like figure. Next take a chair and a table, and place the chair in the center of the background and the table on the opposite side to the ghost. Seat the same subject in the chair at the table, focus again, and give full exposure, which, if the light is good, should be about two seconds. Develop and print in the usual way.

Any object that you wish to be seen through the shadowy figure must be subjected to a quarter of a minute's exposure before the figure is placed in position.

The Twin Brothers.—To make this picture, place the subject in position on the right of the center of the black background, focus, and expose for two seconds in good light. Now place the subject on the left of the center of background and focus again, giving the same exposure. If you have left room enough between the two figures, you may now take a chair and place it in center of background and seat the subject in it, focus, and give again the same exposure. Develop plate and you will have the two, or three, twin brothers. This line of photography offers a great scope for originality and skill, and I would be very glad to hear of an exhibition held for this kind of picture alone.

ARTHUR SMEDLEY GREEN.
4517 Main St., Frankford, Pa., March, 1891.

Rust.

At a recent meeting of the Leeds Association of Engineers, Professor Smithells delivered a lecture on "Rust." He remarked that if they were to do anything on the subject of rust, they must begin by studying the conditions under which rust was formed, getting to know as much as possible about the phenomenon itself. The question was, Was it the chemist or engineer that was to tackle the problem? The answer in this case, as in so many others, was that the two must work together, they must combine theory and practice. His object would be mainly to take the chemist's attitude, and to explain to them the chemistry of rust, and to hint at one or two ways in which attempts had been made to obviate its formation.

Rust, of course, was more or less a general phenomenon. It was not restricted to iron, but was most noticeable in the case of iron because iron was the most abundantly used metal, because the rust of iron formed rapidly, because it assumed a scaly character, because of its color, and because of the fact that rust was a thing that appeared to grow in the case of iron, and it did not grow so rapidly, if at all, in the case of other metals. Most metals, of course, did rust. They knew they could not expose the bright surface of copper or zinc without the surface becoming dim. These metals might, therefore, be said to rust in their respective ways, but the rusting was very slight as compared with iron, which was the most susceptible to rust. Iron rust was found to consist of three elements—iron, oxygen, and hydrogen. That rust did contain water could be shown by the simplest experiments. That rusts were oxides they could easily prove, because they could produce rust by burning metals in oxygen alone. Hence there could be no other element present; but the way that might appeal to them would be by getting the metal back again from the rust, and the oxygen as well.

The lecturer demonstrated this by experiments with iron rust. The experiment he had done, he remarked, was a very suggestive one, because in getting the iron back from the rust in that particular operation he had done what had to be done so often in the process of soldering. They knew that before they could unite two pieces of metal by solder they must use a flux. The reason was that the two metals might be covered with a thin film of rust, and the solder would not adhere to these two unclean surfaces. What was the cause of iron rust? They all knew that rusting was favored by the presence of the air, and by the presence of moisture, but they wanted to know which of these two was the active agent, whether both were necessary, and whether anything else took part in the process. They wanted to know why rusting went on so rapidly and at different points, and how it was affected by the different composition and qualities of the metal, and by impurities in the metal, in the air, or in the water. Professor Smithells then showed some specimens of iron in jars, which he had been preparing for some time. One was a piece of iron in dry oxygen, and he explained that that would not cause the iron to rust.

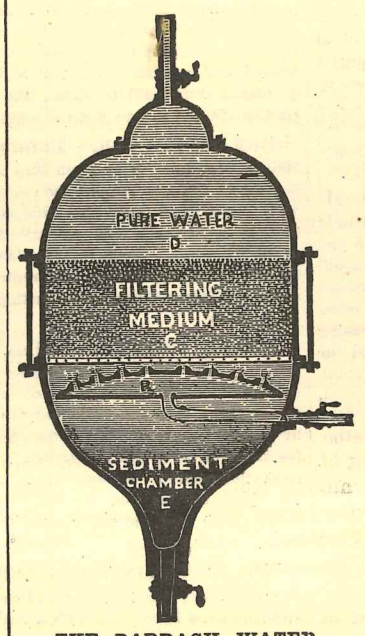
Next he showed a piece of iron which had been sealed up in water for some days, remarking that it was found that when they excluded air and other gases from the water no action took place, and a second conclusion was that water alone would not affect iron. The next question was—Would air and water together affect iron? That experiment had been tried, and it had been shown that, wherever action had taken place at all, the action had been exceedingly insignificant, and the question arose—What was it that was absent and that caused the rust? The one ingredient which was present in one of the jars, and was not present in the cases he had shown, was carbonic acid gas.

Carbonic acid gas existed in the atmosphere to a small extent, and it was this gas in the air that was all important in the operation of rusting. Pure air, pure water, pure carbonic acid, would not act singly upon iron; pure water and pure air would not act together upon iron; carbonic acid and air would not act upon iron, but when they had carbonic acid, water, and air together, they got rust. It was carbonic acid that really set up the rust action, and when it was formed, the carbonic acid was liberated and attacked the layers beneath. That was why rust had got the property of traveling inward. How could they prevent this action of rusting? There were many things which had been tried. They might paint the iron, and if they observed certain precautions, they might have an effective method.

One precaution was that the metal must be perfectly clean. A spot of rust embedded below a coat of paint would often break out of itself. Then there was the method of covering the iron with oils and tarry matters. There was also the process of galvanizing iron, the process of enameling, which was very useful for small articles, but the enamel was apt to chip off, and there was the Bower-Barff process, which was worked at Keighley, and which was an admirable process. Alluding to boilers, he said that by putting soda into them not only did they correct acidity of the water, but they introduced something which would absorb the carbonic acid gas, and prevent it acting in a rusting capacity.

THE DARRAGH WATER FILTER.

Of the many water filters that have from time to time claimed the attention of the public, this, according to the inventor, is the only one that perfectly clears the water of all animal, vegetable and earthy matter, without in the least retarding its flow, and thoroughly filters any quantity that can be passed through the inlet.



THE DARRAGH WATER FILTER.

It may be applied to the main where the water enters the premises, and thus all the water delivered will be filtered.

The water enters the filter through pipe, A, into spreader, B; from there, by a very slow movement, to and through the filtering medium, C, which is four hundred times as large as the supply pipe; thus passing the water, without retarding its force, to space, D, from which the filtered water is drawn.

The space, E (around and below the spreader), is the sediment chamber into which all impurities fall when separated from the water.

To cleanse this filter it is only necessary to partly close the valve on the supply pipe, open the lower outlet valve, and in a few seconds it will be cleaned and ready for use; and this should be done as often as once each month.

Filtered water should be used where it is possible to obtain it, for health depends upon it.

Probably impure water is productive of more sickness and death than any other single cause. In it are hidden the germs of disease not visible to the eye, and seldom detected by the taste. In cities and towns especially, where nearly all the water is collected in reservoirs, tanks, or vessels of some kind, and distributed through pipes, there are accumulations of sediment through months and years, constantly polluting the water passing over it, and taking up the poison lurking in the deposit, and transmitting it for drinking, bathing, and general use.

Those who are familiar with the tank process of storing water, for family and other use, will bear testimony as to the vile matter that accumulates in them; and to the fact that they are seldom cleaned.

Those who use steam boilers, or hot water tanks, know by experience the cost resulting from the use of water for heating purposes, or generating steam, which is supplied direct from the pipes. Many boilers have been destroyed by the accumulation of animal and vegetable matter contained in Croton water (which is claimed to be the best in use), notably the steam plant in the Park Avenue Hotel, New York, where the boilers have recently been replaced by new ones, being entirely destroyed by the flues and tubes being filled by sediment baked to a solid mass, and due to use of unfiltered water. The Darragh Water Filter Company, 1539 Broadway, will give further information.

THE total forest area in the United States is estimated at 481,764,599 acres.

Differential Diagnosis of Dental Pain.

In the *Journal* of the British Dental Association, Mr. H. Baldwin, M.R.C.S., gives the following useful table. For simplicity, the two kinds of pain may be called "nerve pain" and "pericemental pain."

NERVE PAIN.	PERICEMENTAL PAIN.
Arises suddenly.	Arises gradually.
Terminates suddenly.	Terminates gradually.
Is not continuous.	Is continuous.
Is chiefly non-localized.	Is distinctly localized.
*** Much neuralgia.	*** No neuralgia.
Tooth always sensitive to thermal changes.	Tooth not sensitive to thermal changes.
Percussion or pressure does not necessarily cause pain.	Percussion or pressure causes much pain.
Tooth not raised, not loosened.	Tooth raised and loosened.
Tissues around not inflamed, not tender on pressure over root.	Tissues around inflamed, tender on pressure over root; in chronic cases tissues thickened.

In using this table it must always be borne in mind that the two conditions of pulp inflammation and pericemental inflammation may co-exist either in the same tooth or in different teeth; and then the relative importance of the two inflammations will be determined by the relative severity of the two sets of symptoms, and sometimes by the history.

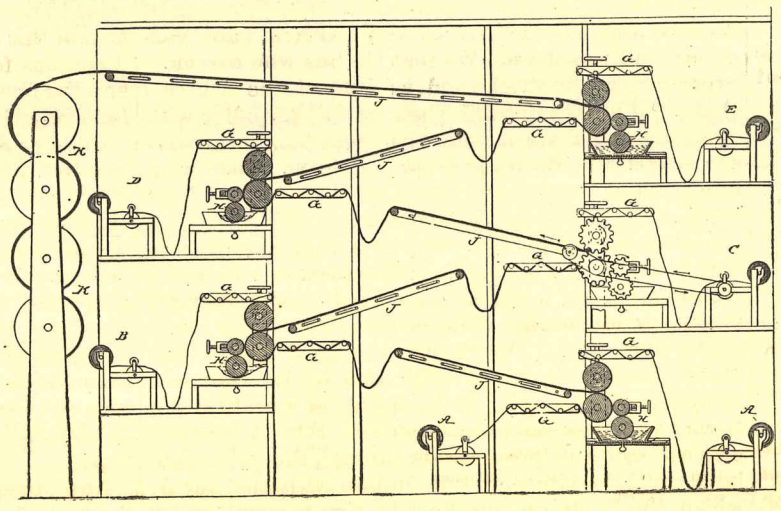
Good Suggestions for Dyspeptics.

A writer, evidently of a practical turn of mind, tells a contemporary how easily the wakeful dyspeptic can be made to slip off into the land of dreams. He says:

"The dyspeptic, of course, eats a light supper, may resort to the use of a towel, wet with tepid water, and covered with a dry cloth, the whole then applied to the pit of the stomach. Before the sufferer knows it she will float into shadow land, such is the sympathy between the organs of digestion and the brain. Owing to the position of the stomach, a light sleeper ought to sleep on the right side instead of the left, never on the back. If there is a tendency to cold feet, a thin woolen blanket may line the lower third of the bed. The limbs ought not to be greatly flexed, a position which prevents free circulation, and they should rest one upon another lightly. The night light, where used, ought to be a tiny taper, and not gas or kerosene, both of which devitalize the air. A darkened room is the best. Nature puts out her light, and draws the curtain of darkness for a purpose. With good habits, physical and mental, and a determination not to deal with anodynes, sleep may be won from its shyest lair to watch over the restless pillow."

A CARD-BOARD MAKING MACHINE.

An easily operated machine for making card or paper boards, by pasting together two or more layers of paper, is shown in the accompanying illustration, and has been patented by Mr. John McCoy, of No. 525 West Philadelphia Street, York, Pa. In the picture, A A represent the starting rolls of paper, and B, C, D, E, successive adding rolls, the number to be increased or decreased according to the thickness of board to be made. The tension device, G, pasting rolls, H, and driers, J, are alike for the several parts. The pasting rolls are each journaled in a paste trough, and apply the paste to the inner face of one of the layers of paper as the paper passes from the tension device and before it passes between the pressure rolls. The drier, J, receives the paper immediately after it leaves the pressure rolls, and serves as a support and carrier for it toward the next tension device and pasting roll, where the next sheet of paper is added. The driers are in the form of endless canvas aprons supported on rollers, one of which is driven and the other turns loosely, while steam or other heating pipes are arranged between the inner surfaces of the aprons, whereby the heat may be evenly applied to all parts of the board or card, and the canvas be kept constantly dry. The opposite sides of the web forming the card-board are alternately exposed to the successive driers in its passage through the machine, the board, after passing the last pressure rolls, being conducted over a drier to a set of calendering rolls, K. It will be seen that with this machine, linen, cotton, or other cloth may be readily pasted in with the paper when so desired, or one or both of the last adding rolls may carry a tinted paper with which to form the finished surface of the card-board.



McCOY'S MACHINE FOR MAKING CARD-BOARD.

Negro Physicians.

The fifteenth anniversary of the Meharry Medical Department of Central Tennessee College was held February 19th. The Nashville *Journal of Medicine and Surgery* says that more than one-half of the educated colored physicians of the Southern States are graduates from Meharry College. With scarcely an exception, they have been cordially received by the white physicians, who have consulted with them in dangerous cases, and assisted in difficult surgical operations.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CABLE RAILROAD SYSTEM. — Leonard Cutshaw, Denver, Col. This invention consists principally of an endless still cable and a double track, the cars traveling along one track and returning on the other, while the cable is carried forward intermittently by the cars themselves, owing to the rolling off of the cable on the drum, the cable being moved by each car a distance equal to that part of the cable passed around the drum. Pulleys carrying weights are adapted to engage part of the still cable to automatically take up and compensate for slack in the cable incident to taking cars on and off, while a special device is provided for placing the cable on and off the drums of the cars, and automatically clamping and releasing it.

CATTLE CAR. — Ferdinand E. Canda, New York City. Movable partitions or gates are provided by this invention, for use in cars which it is desired to employ to transport cattle one way and freight the other, such partitions, when not employed to divide the car into stalls, being moved to positions beneath the car roof. The partition is in skeleton form, made of bars united by links, the bars being operated by a novel style of endless chains, and sliding in vertical and inclined ways, the partition being readily placed in the desired position or moved where it will be at rest out of the way by means of a novel operating mechanism.

Electrical.

AUTOMATIC WEIGHING SCALE.—John V. Davis, Ashland, Ky. Combined with the scale beam and its poise is a shunt circuit electric motor mounted on the scale beam, gears connecting the motor with the poise for adjusting it, while a set of mercury cups is provided for establishing connection between the outside circuit wires and the field magnets of the motor, and a set of contacts with reversed poles for transmitting a reversed current to the armature of the motor. In a scale thus arranged the poise runs out to the point of exact balance on the scale beam from the mere application of the load, thus automatically indicating the weight, and, if desired, printing or recording it.

Mechanical.

RATCHET WRENCH.—William H. Haire, Morristown, Tenn. This is a tool designed for use in any manner in which an ordinary wrench may be employed, while it is made to be conveniently manipulated right or left in very limited spaces. The wrench has a stationary and a movable jaw, an adjusting screw turning in the fixed jaw being fitted to a threaded opening in the movable jaw, while the handle is held to revolve around a stud projected from the fixed jaw, a cap block on the upper end of the stud having a toothed periphery engaged by the spurs of a spring-pressed dog pivoted upon the handle.

BEVELING MACHINE. — Michael O'Gorman, Jersey City, N. J. This is a machine designed more particularly for beveling glass, and the shaft or arbor which carries the grinding disk has various adjustments for changing the angle or pitch of the disk, the disk shaft being journaled in an adjustable carriage held in the main frame so that the adjustment of the grinding disk may be easily effected. Combined with the grinding disk is also a counterpoise adapting the disk to be held in contact with the object being beveled by a yielding pressure, to obviate danger of breakage from a hard substance accidentally coming between the glass and grinding disk.

HUB BORING MACHINE. — Theophile Paquette and Frederick R. Child, Webster, Mass. An externally threaded tube is mounted between the uprights of a frame, while an operating nut travels on the tube and clamping jaws are pivoted to its front end, a nut and a screw-threaded boring tool spindle passing through the nut and tube. The machine is designed to be simple and durable in construction, and to quickly and accurately bore the hub of a wheel.

RAILWAY DRAWING HEAD. — Samuel W. Hildreth, Voluntown, Conn. This is an evener for cotton-working machinery, designed to produce a uniform sliver and prevent the cotton from clogging the back and front rolls in case the belt on the cone pulley slips. The invention covers a novel combination and arrangement of parts whereby a uniform speed is given the front rolls and calender rolls, and a uniform tension is given to the trumpet, affording the same weight of cotton sliver whether the carding comes into the railway head too light or too heavy.

LATHE MECHANISM. — Martin C. Bollenbacher, Bloomington, Ind. This is a table-operating mechanism for lathes employed to turn the spokes of vehicle wheels, where the wooden blank is secured between spindles whose bearings are attached to a reciprocating table which carries the blank inward against rotary cutters. The improvement covers a novel combination and arrangement of means for operating such a table, enabling the operator to work the lathe with greater ease than by the means heretofore employed.

DRIVING MECHANISM. — Thomas S. Barwis, Calgary, Canada. A lever is pivotally connected with a crank arm on one of the trunnions of the device to be driven, and a link pivoted on a bracket is pivotally connected with the lever, forming a simple mechanism for driving churns, boats, etc., and one in which a dead center position is readily avoided.

GROOVE CUTTER FOR BORED WELLS.—Joseph L. Addison, Quaker City, Ohio. This invention provides a machine for boring lateral channels from the main bore of a well, while maintaining an open exit for the product. A cylindrical casing is supported at any desired point in the well and adapted to be revolved on its support, the casing carrying a flexible chain provided with a cutting bit at its lower or outer end, the chain and bit being forced laterally outward from the casing while the latter is revolving, thereby cutting a horizontal groove or channel around the casing.

Agricultural.

HAY RAKE AND LOADER.—Van Rensselaer Cole, Republic, Ohio, and Charles W. Neikirk, West Lodi, Ohio. This is an implement designed to be attached by its tongue to a wagon body, when, as the wagon is drawn forward, rear rake teeth gather up the hay, which is conducted by a reel to an elevator, consisting of endless belts and their slats, and delivered to the wagon body. The attachment is designed to be operated with a minimum expenditure of power, and dispenses with the ordinary drive and supporting wheels, substituting therefor a reel.

Miscellaneous.

LETTER BOX. — Charles A. Whelan, Aspen, Col. This box is preferably of metal, and has a rounded top with a hinged and locked door at the lower portion of one of its ends, under the control of the mail carrier. An oscillating cylinder is hung on trunnions in the box, a cut-off door being operated by the cylinder to prevent access to the bottom of the box when the cylinder is rotated to open the top of the box for the deposit of letters or packages, thus forming a simple and secure street letter box.

PORTABLE DARK ROOM. — James H. Markley, Brooklyn, N. Y. This device consists of a casing open at one side, and closed by hinged end doors, an extension hinged to the bottom and a hood-supporting frame hinged to the top, the frame and extension being constructed to swing toward each other and be concealed by the doors when closed. The casing has shelves for chemicals, a water tank, etc., and the construction is adapted for convenient transportation, to be quickly set up by photographers wherever needed, and furnish a convenient and ready means of developing plates in order to get a satisfactory negative before leaving the place of taking the picture.

POCKET KNIFE.—William Schmachtenberg, New York City. This invention provides an inexpensive method of making a neat, well finished knife, of a substantial character. The two side lining plates and an integral back plate are formed of a sheet metal blank, and an intermediate lining plate, for four-bladed knives, is engaged at one end with a lip on the back plate. The blades are held by a transverse rivet, and springs for the blades are engaged at one end by the blades and near the other end by a transverse key pin, which passes through the lining plates and presses the springs against the blades.

BICYCLE OIL CAN HOLDER. — Loring H. Bannister, Youngstown, Ohio. This holder is made of a single plate of elastic sheet metal, cut to have two pairs of clasp limbs, one of which has base flanges, while the middle portion of the holder is bent to embrace a cycle standard. The clasp limbs are adapted to removably hold an elongated cylindrical oil can seated on the base flanges, screw bolts and nuts retaining the holder and oil can upon the cycle frame, the can being quickly placed in firm position and readily removed.

ROLL PAPER HOLDER AND CUTTER. —Ezra E. Staninger, West Salem, Ill. This is a device adapted to carry two rolls of paper of different widths, to form wrappers for packages of different sizes, in connection with which independent knives are used, one for each roll, while a single intermediate bar serves to carry springs which keep both knives forced up against the rolls. The paper is drawn from the roll as required, and is then torn or cut off by pulling it sidewise over the cutting edge of the knife, which is spring-pressed against the roll.

SHOE.—Gustav Schultz, New York City. This is a novel form of shoe specially designed for the use of people having weak ankles, or those with whom the instep is sunken or caved in, to project inwardly. The shoe is made with a sole extending outward at its inner edge beyond the line of a normal sole, and provided with a heel stiffener, the inside of which is extended forward to the ball portion.

FIRE ESCAPE.—Carl G. Grunz, Grand Island, Neb. This device comprises an extensible frame, with the upper member mounted to slide in the lower member, a drum being pivoted in a frame on the extensible frame, and a drum at the base of the latter, with means for turning the drums and a rope ladder made in sections extended over them. The escape is placed near a burning building and the extensible frame is raised by means of the drums and connecting cables, when pivoted bridges are dropped into the door and window openings of the building for the occupants to escape and descend by means of the rope ladder.

FIRE ESCAPE. — Robert M. Yorks, St. Paul, Minn. This escape consists of a collapsible ladder made up in sections, so that it may be easily adapted to the height of any building, the sections being adapted to be hooked together. A cross bar is adapted to be attached to the ladder when it is within the room, and the cross bar has wardrobe and hat hooks and a suitable brush holder, making the escape a convenient household article. It is designed to be collapsed so as to occupy but little space, so that it may be readily stowed away within a room, or it may be permanently attached to the wall if desired.

PACKAGE ELEVATOR. — Burtis Van Hennik, New York City. This is a device for use in connection with printing presses, whereby packages of paper to be printed may be conveniently elevated from the floor and placed at the side of the feed table and transferred thereto. The device is adapted to be set up in any press room, occupying space not heretofore utilized, and can be constructed and erected at a low cost, and attended by unskilled labor.

DOOR OR WINDOW SCREENS.—Mariam A. Baldwin, Pueblo, Col. This invention provides a screen attachment, to render the screens impervious to wind, dust and cold, and one which is durable, inexpensive, and readily applied. It consists of a fabric casing, formed of canvas, ticking, felt, or similar article, adapted to inclose the screen, one side of the casing being left open for the introduction of the screen, while the ends and sides of the casing have flanges to serve as weather strips.

GATE. — Frank Williams, Cisco, Ill. This invention provides an improved sliding gate adapted to be operated by one approaching it in a vehicle from either direction, and also designed for easy movement by one upon the ground. Novel features of construction are introduced to facilitate the movement of the gate, and prevent interference therewith on account of snow and sleet, while the gate is light, strong, and inexpensive.

BEATER AND MIXER.—John W. Condon, Rochester, Ind. This is a machine for confectioners' use, the invention covering a peculiar construction of the driving gears, in combination with the mixing and beating devices, to adapt the machine for many different uses. It gives the high speed required to revolving beaters to beat the whites of eggs; for whipping cream it gives a rapid motion in the center of the cylinder and a slow motion at the circumference; while in mixing icing and pound cake, where a low speed is needed, and in mixing jelly roll and sponge cake, requiring an intermediate speed, the machine may be readily adapted to give just the required service.

BREAST COLLAR.—Thomas W. Fisher, Helena, Montana. This is an improved collar for the harness of draught animals, so constructed as to obviate constriction upon the windpipe and blood conduits in the animal's neck, and transfer the load strain to the shoulders. The invention also furnishes means for the quick application and removal of the breast collar and attached harness in putting on or taking off the harness.

HORSE COLLAR. — Silas T. Marlette, Niagara Falls, N. Y. This invention covers a novel construction and combination of parts, in which the side sections, to which the hames are fitted, are joined by connecting pieces lapped together and secured by fastening devices, the construction bracing the parts from independent movement to the front or back. The fastening bar has a handle arm secured by a spring catch, and the collar can be readily adjusted to any desired size.

HORSE TRAINING BLIND. — Brewster A. Long, Troy, Penn. This blind has a main portion provided at its lower edge with a rearwardly projected flange, along the edge of which is a cushion to fit closely against the face of the animal. The blind is so formed as to shut out all view forward and to the side, at the same time leaving the horse's eyes exposed to the air and light, and not obstructing the view to the rear, being designed, in training horses to trot, to give a proper knee action, prevent interfering in front, and obviate forging.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN

BUILDING EDITION.

APRIL NUMBER.—(No. 66.)

TABLE OF CONTENTS.

1. Plate in colors showing a cottage on Lombard Avenue, Chicago. Two floor plans, perspective elevation, etc. Estimated cost $2,800.
2. Colored plate of an attractive residence erected at Bridgeport, Conn. Cost $6,900 complete. Floor plans and two additional photographic elevations.
3. A cottage costing $2,700 complete, erected for Mr. R. H. Keller, at Rutherford, N. J. Three elevations and plans. Mr. U. D. Peck, architect, Rutherford, N. J.
4. Photographic view and two floor plans of a cottage at Austin, Chicago. Estimated cost $3,300.
5. A row of new dwellings on West 82d Street, New York. Cost of each house $20,000 complete. Messrs. Berg & Clark, New York, architects.
6. Cottage recently erected at New Haven, Conn. Cost $6,850 complete. Floor plans and photographic perspective elevation.
7. An attractive dwelling erected at Yonkers, New York, at a cost of $6,000. Photographic elevation and floor plans.
8. Two photographic views of the beautiful residence of Mr. Noakes, on Riverside Park, New York City, a colored view of which appeared in the March issue.
9. Sketch of a sixteen story office building to be erected at Chicago. Cost $750,000.
10. Sketch of a water-cooled building. One of the novelties proposed and patented for the World's Fair at Chicago.
11. Recently erected English houses. Plans and perspective views.
12. Miscellaneous contents: How to catch contracts.—Toggle bolt for electrical and other fixtures, illustrated.—Composition for retarding the setting of plaster.—Quarrying marble.—The education of customers.—Iron and steel for building purposes.—An improved sanitary earth closet, illustrated.—Stamped metal ceilings, illustrated.—The Plaxton hot water heater, illustrated.—A hot water heater for soft coal, illustrated.—An improved woodworking machine, illustrated.—An improved casing for steam pipes, illustrated.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural publication in the world. Sold by all newsdealers.

MUNN & CO., PUBLISHERS,
361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale—New and second hand iron-working machinery. Prompt delivery. W. P. Davis, Rochester, N.Y.

Acme engine, 1 to 5 H. P. See adv. next issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J,

Burnham standard turbine. Burnham Bros., York, Pa.

Best Ice and Refrigerating Machines made by David Boyle, Chicago, Ill. 155 machines in satisfactory use.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Gun and Machine Makers' Screwdrivers, drop forged in best Tool Steel. Billings & Spencer Co., Hartford, Ct.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 13.

"How to Keep Boilers Clean." Send your address for free 96 p. book. Jas. C. Hotchkiss, 120 Liberty St., N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

NEW BOOKS AND PUBLICATIONS.

PRACTICAL GRAINING, WITH DESCRIPTION OF COLORS EMPLOYED AND TOOLS USED. Illustrated by forty-seven colored plates. By William E. Wall. Philadelphia: House Painting and Decorating Co. 1891. Pp. 59, xiii. Price $2.50.

The eminently practical nature of this work and the beautiful colored plates used in the illustration of the text entitle it to full commendation. The colored plates are of unusual merit, the reproduction of the wood effect being really surprising. A full description of tools, graining machines, transfer paper, etc., is given.

BOSTON SOCIETY OF NATURAL HISTORY. Guides for Science Teaching. No. VIII. Insecta. By Alpheus Hyatt and J. M. Arms. Boston: D. C. Heath & Co. 1890. Pp. xxiii, 300.

This most excellent work is issued under the auspices of the Boston Society of Natural History, forming the eighth of their guides for science teaching. It goes through the orders of insect life systematically and, in thirteen plates, gives the analyses or description of typical specimens thereof. While a guide for science teaching, it will be of use for all serious students of entomology.

THE THRESHOLD OF SCIENCE. A variety of simple and amusing experiments illustrating some of the chief physical and chemical properties of surrounding objects, and the effects upon them of light and heat. By C. R. Alder Wright. With numerous illustrations. Philadelphia: J. B. Lippincott Company. 1891. Pp. xxi, 389. Price $2.

While many things in this work are open to criticism, it will be found a useful work to the student and experimenter. Its numerous illustrations and popular treatment of the subject bring it within the capacity of ordinary scientific readers. Many of the titles of the articles partake too much of the old idea of natural magic, such as "To Turn Water Apparently into Milk by the Breath." In his treatise on soap films, too, some details are wanting, the use of the condensation chamber in the blowing tube not being spoken of. He also adheres to the term "radiant heat," now being dropped by many advanced physicists. What we have said in criticism of the work cannot affect its value, which is so great that we can afford to overlook many of its minor defects.

MUSHROOMS: HOW TO GROW THEM. A practical treatise on mushroom culture for profit and pleasure. By William Falconer. New York: Orange Judd & Co. 1891. Pp. 172. Price $1.50.

The practical side of mushroom life is given in this excellent little work. The author describes in detail the methods of growing the edible fungus on a large and small scale, in special houses or in dwelling house cellars. He reviews the relative advantages of the different methods of laying down beds, dividing and planting spawn, and the influence of temperature and general conditions on the crop. A strong plea is made for the profitable nature of the culture of mushrooms and for the readiness with which it can be carried on for family use or for sale of the product. The book is illustrated where required, and seems to fill a distinct place in agricultural literature.

THE QUARTERLY REGISTER OF CURRENT HISTORY. Published by the *Evening News* Association, Detroit, Mich. Vol. I. No. 1. Price $1 per year.

The object of this magazine, the first number of which has just been published, is to provide a current history of the times, in such form that it may be readily preserved. Each subject will be treated briefly, and will be made as readable as possible. A very wide range of subjects has been selected. Such a work as this would be invaluable to those who have not the time or opportunity to read the daily papers regularly or who wish to preserve a record of our own times. The first number unfortunately does not contain an index, but this defect will undoubtedly be remedied, either in future issues or at the end of the year. In size and general appearance it resembles the monthly magazines.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2959) A. G. B. asks: 1. Please give receipt for cleaning gilt picture frames. A. Wash with cold water and Castile soap or with beer. 2. A receipt to enamel a zinc bath tub. A. Use ordinary paint or one of the enamels advertised by manufacturers. 3. How to clean a galvanized boiler. A. Use sand and soap.

(2960) S. D. L. asks a receipt for making cotton or any kind of cloth waterproof. A. Apply paraffin with a hot iron.

(2961) C. E. S. asks for receipts for making stencil inks in cakes—black, blue, green, and red. A. Mix the coloring matter, lampblack, Prussian blue, chrome green, or vermilion, with an equal part of gum arabic and enough glycerine to give the desired consistency. For black use 1 part lampblack and 2 parts Prussian blue.

(2962) B. O. G. asks how liquid glue is made. A. Dissolve 8 ounces best glue in ½ pint of water. Add slowly 2½ ounces strong nitric acid (36° Baume), stirring all the while. After effervescence ceases, cool and bottle. Or simply dissolve glue in acetic acid.

(2963) A. F. B. asks: 1. What is fluoride of ammonium, and what are its uses? A. A compound of ammonium and fluorine, NH_4 Fl. It is used in analyzing siliceous minerals, and is also of use in etching glass. 2. How can calcium chloride that has been used for drying gases be put in condition for use again? A. By heating with occasional stirring until dry and pulverulent, or by pushing the heating to fusion, pouring into a shallow vessel, and breaking up into pieces. 3. Does 2000 volts mean anything as a danger, unless mention is made of its associated amperage? Is it a proper use of electrical terms to say, "I have taken a charge of 100,000 volts, but the current amperage was so small that it didn't hurt me"? A. It means something, but the associated amperage cannot be stated, as it will vary with the resistance of the person and with the nature of the connection between his person, the wire, and the earth. We would amend the statement to read, "I have taken a discharge of 100,000 volts difference of potential," etc.

(2964) B. B. asks how fresh butter can best be prepared to enable it to stand a twenty-four hours' journey in a hot climate and to preserve it sweet and fresh. A. Various methods are given. One method is to heat the butter to 180° Fah., and keep it melted, skimming it from time to time until perfectly clear. It is then poured off into another vessel and cooled as rapidly as possible by surrounding the vessel with ice or cold water. Another way is to cover the butter in its vessel with half an inch of salt packed down, and cover. A little water may be added.

(2965) W. B. G. asks: I have a letter written in camp in 1863 which I desire to keep, but which is badly faded; some parts of it are so dim it is hardly readable, and I write to ask if you can tell me what I can use to prevent further fading and also to restore what is now so dim. I am very anxious to preserve the letter and will be thankful if you can tell me how to do so. A. We would suggest dipping the letter in a solution of tannic acid. Instead of doing this you might photograph it. This might bring out the faded parts in the photographic print.

(2966) G. P. Y. says that listerine has proved in his case to be a remedy for dandruff. To be used on the head full strength daily for a week, and after that once a week.

(2967) G. L. B. asks if there is any process that will deodorize castor oil, *i. e.*, take away its disagreeable and nauseous taste. Is there any work on the subject of deodorizing oils? A. Castor oil can be taken in disguised form by mixture with effervescent root beer. There are no books devoted to the specific subject you mention. It is treated of in various works on oils, their chemistry, etc.

(2968) C. A. S. asks: Does gasoline gas when generated by heat or otherwise return back to gasolene when under pressure? And if so, what will prevent it? A. It is a question of proper heating. If heated to a high enough temperature, the gas formed will be reasonably permanent, and will only condense at low temperatures. The limitation to heating is the formation of lampblack.

(2969) L. S. W. asks for information concerning the manufacture of chewing gum. A. Take of balsam tolu 4 ounces, white resin 16 ounces, sheep suet 1½ ounces more or less and melt together. Of above mixture take 2 ounces, white sugar 1 ounce, oatmeal 3 ounces. Soften and mix on a water bath. Roll the pieces in finely powdered sugar or flour to form sticks, etc., as desired. Paraffin with a little olive oil and glycerine may be melted together for a chewing gum. The exact mixture will vary with the season, etc.

(2970) C. C. asks: 1. Is nickel sufficiently magnetic to be attracted by an ordinary fixed magnet or an electromagnet? If so, how powerful must the magnet be? A. Any magnet will attract nickel. 2. What metal is non-magnetic and sufficiently hard to resist abrasion like steel? Is phosphor bronze suitable? A. Phosphor bronze or bell metal. 3. Are dynamos with slow speed as efficient as rapid ones? A. Yes. 4. Is there any gearing suitable for reducing speed from dynamos besides cog wheels, friction gearing or belts? A. It may be done by hydraulic or pneumatic devices. 5. Is ordinary friction gearing considered as efficient as cog wheels? A. This depends upon the use to which the gearing is applied. Cog gearing has the advantage of being positive. 6. Can you give the composition of the Le Page glue sold in every hardware store? A. Le Page's glue is a patented article. It is made by desalting, cleaning, and bleaching fish stock in solutions of soda salts, then boiling in water impregnated with borax, then expressing and filtering the glue, and afterward evaporating it through a vacuum coil.

(2971) B. L. asks (1) directions for making and charging a Leyden jar. A. For directions for making a Leyden jar we refer you to SUPPLEMENT, No. 279. 2. What size of Leclanche cell would be necessary to give an electromotive force of 12 volts? A. Nine Leclanche cells will give an E.M.F. of a little more than 12 volts. This battery has an E.M.F. of 1·47 volts per cell. 3. Can I magnetize a bar of steel ⅛ an inch by 1½ and a foot long with an electric light dynamo? If so, how? A. Harden your bar at the ends and draw to a dark straw color and place it in a suitable coil connected with the dynamo. The proportions of the coil will depend on the kind of current generated by the dynamo.

(2972) J. L. M. asks: 1. Can the porous cup of Leclanche cell be cleaned after use for some time? Will boiling do any good? A. Soaking the porous cup in warm water will clean it. 2. What would make a crucible for melting copper in small quantity? A. You cannot readily make crucibles. Better purchase them. They cost only a few cents each.

(2973) W. R. B. asks: Can you give me the ingredients of any composition used by fire eaters to wash their hands and mouths with? A. A very strong solution of alum is recommended, and also a dilute solution of sulphuric acid. This is for the hands. The mouth is best untreated. By the use of fusible alloys the effect of taking melted lead into the mouth is produced.

(2974) H. L. F. asks: Can you tell me of any harmless preparation, and where procured, that can be used to stain the face and hands dark brown or as near the color of sunburn as possible? Something that will be lasting. A. Nothing that is lasting can be recommended. Dilute permanganate of potash solution or extract of green walnut hulls are the best. Ascertain the strength by trial upon the arm.

(2975) E. W. G. asks: 1. Is glucose as used in the manufacture of candy injurious to health when eaten? If so, why? A. Probably not. 2. How is the commercial glucose of this country generally made, from what materials? A. By treating starch with dilute acid.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 7, 1891,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Alarm. See Fire alarm.
Ammeter or voltmeter, H. C. Shubert ... 449,766
Animal trap, J. T. T. Kisinger ... 449,857
Ash pan, S. B. Dexter ... 450,005
Axle cap, carriage, Wastell & Day ... 449,786
Axle, car, Lyon & Sproul ... 449,684
Axle skein for vehicles, L. L. Tapp ... 449,979
Bag fastening, E. Oldenbusch ... 449,912
Bar. See Finger bar.
Basin fixture, H. Pietsch ... 450,034
Basins or baths, supply connection for, E. Hammann ... 449,880
Basket, W. H. Snow ... 450,112, 450,113
Basket mould, W. H. Snow ... 450,111, 450,114
Bearing, ball, G. F. Simonds ... 449,952 to 449,968
Bed, folding, J. B. Anderson ... 449,892
Bee hive, W. D. Pennock ... 449,760
Beer, device for drawing steam, C. Harth ... 449,853
Bell, A. F. Stanley ... 449,832
Bell ringer, automatic, W. W. Slater ... 449,866
Bell, ringer, machanical, G. J. Gollmar ... 449,904
Belt, tennis, E. W. Whittaker ... 450,050
Block. See Paving block.
Blower, fan, F. F. Landis ... 449,743
Board. See Switch board. Wash board.
Boats, row lock for, J. Williams ... 449,787
Boiler. See Steam boiler. Wash boiler.
Boiler cleaner, R. P. Faries ... 449,671
Boiler for generating steam, B. Ford ... 449,735
Bolting screen, T. & G. M. Parkinson ... 449,913
Book case, revolving, H. C. Andross ... 449,657
Books, binding, H. L. Arnold ... 449,751
Books, etc., storage case for, H. J. Hoffman ... 450,124
Boots or shoes, outer soling welted, M. L. Keith ... 449,882
Bottle stopper, W. Painter ... 449,822
Box. See Letter box. Post office lock box.
Box fastener, W. Beck ... 449,811
Bracket. See Shade bracket.
Brake. See Vehicle brake.
Brick for tile machines, die for, G. D. Herrold ... 449,854
Broom holder, G. Townsend ... 449,982
Brush, R. Schulz ... 450,042
Brush and making the same, A. H. Wolcott ... 450,090
Buckle, W. E. Smith ... 450,110
Buckle, suspender, D. Lippy ... 449,683
Buckle, suspender, C. Schwartz ... 449,951
Building, portable, L. D. Jones ... 449,035
Button, F. E. Hall ... 450,069
Button clasp, C. La Dow ... 449,940
Button cutting apparatus, pearl, J. Cleret ... 450,057
Button piercing machine, pearl, J. Cleret ... 450,056
Buttons, machine for the manufacture of pearl, J. Cleret ... 450,095
Cable crossing apparatus, E. Werner ... 449,985
Can. See Milk can.
Candy mould, S. E. Ball ... 449,869
Canvas stretcher frame, C. Fay ... 449,875
Car coupling, A. G. Canada ... 449,928
Car coupling, Genese & Schmidt ... 449,876
Car coupling, O. C. Harris ... 450,015
Car coupling, E. P. Kinney ... 449,798
Car coupling, H. E. Moomaw ... 450,085
Car coupling, J. H. Priestley ... 449,805
Car coupling, F. W. Smith ... 449,974
Car coupling, M. L. Strother ... 449,715
Car coupling, S. D. Tungate ... 449,718
Car door, R. W. Thickins ... 450,125
Car, electric motor, H. P. Brown ... 449,752
Car, passenger, G. T. Howard ... 450,073
Car stopping device, electric, G. W. Blanchard ... 449,843
Car wheel, W. A. Pearson ... 449,823
Cars, propelling mechanism for electric motor, S. H. Short ... 449,709
Cars, safety attachment for railway, R. M. Smith ... 449,975
Cars, stall partition for stock, B. C. Hicks ... 449,740
Care, trolley support for electric, Robinson & Lander ... 449,886
Cars, vestibule hood for, T. A. Bissell ... 449,896
Carriage, H. P. Wells ... 449,841
Carrier. See Fence wire spool carrier.
Cart, dumping, F. Weber ... 449,720
Case. See Book case.
Casting, J. A. Potter ... 449,701
Centrifugal cleaner, L. Wommer ... 449,788
Chain, driving, C. H. Brampton ... 449,997
Chair. See Railway chair.
Check, service and cash, G. D. Smith ... 449,973
Clasp. See Button clasp.
Cleaner. See Boiler cleaner. Centrifugal cleaner.
Clip. See Tug clip.
Closet. See Cremating closet.
Cloth shearing or cropping machine, Martin & Drake ... 450,028
Clothes wringer, M. N. Lovell ... 450,080
Clothes wringer, W. P. Mason ... 450,029
Coffee, collecting the aromatic and volatile substances from, N. L. Le Turcq des Rosiers ... 449,758
Coffee roaster, O. Hammarstrom ... 449,850
Colter clearer, D. Demers ... 449,669
Combination lock, W. C. Young ... 449,924
Communications, device for forming a deciphering secret, M. A. Wier ... 449,723
Commutator for electric motors, H. Duenner ... 449,774
Composition of matter, G. W. Abell ... 449,653
Confectioners' use, separating and filling machine for, N. A. Ciacher ... 449,668
Cooler. See Milk cooler.
Copy nolder, J. B. Hammond ... 449,934
Corn conveyer, W. Riedel ... 449,703
Cosmetic, remedial, P. Rion ... 450,038
Counting register, C. J. Root ... 450,039
Coupling. See Car coupling. Hose coupling.
Cremating closet, I. D. Smead ... 449,970, 449,971
Culinary or other vessels, handle attachment for, M. Roberts ... 449,807
Cut-out, J. S. Gibbs ... 450,101
Cut-out, A. T. Tregurtha ... 449,767
Decorative relief material, manufacture of, L. Enricht ... 449,873, 449,874
Dental engine, J. W. Gibson ... 449,848
Dental engine, electrical, F. F. Eggers ... 449,847
Depilating composition, J. Perl ... 450,032
Digger. See Potato digger.
Dish washer, M. J. Parmley ... 449,746
Door check, B. T. Raisor ... 449,916
Door closer, check, and alarm, pneumatic, J. H. Abel ... 449,891
Door hanger, W. B. Corp ... 450,003
Draught regulator and spark arrester, C. A. Houston ... 450,072
Draw bars, device for relieving the tension of, Schroyer & Thompson ... 449,828
Dust collector, L. V. Rathbun ... 449,946
Dye, black, H. Reisenegger ... 450,037
Dyeing machine, J. Hussong ... 450,020
Egg crate, safety, C. C. Tilghman ... 449,981
Electric block system, automatic, Carlton & Johnston ... 449,731
Electric conductors, supporting post for, W. A. Stern ... 449,977
Electric connector, G. K. Wheeler ... 449,721
Electric cut-out, A. T. Tregurtha ... 449,921
Electric light systems, circuit breaker for incandescent, Muller & Greene ... 449,780
Electric motors, automatic switch for, W. Baxter, Jr ... 449,662
Electrical lock, H. Grefen ... 450,068
Electrode for electric batteries, carbon, E. A. Le Sueur ... 450,105
Electroplating small articles, apparatus for, F. W. Zingsem ... 449,890
Electrolytic apparatus, E. A. Le Sueur ... 450,103
Electrolytic cell, E. A. Le Sueur ... 450,104
Elevator. See Water elevator.
Elevators with landing switches only, system of operating electric, W. Baxter, Jr ... 449,662
Embalming mixture, T. Holmes ... 450,017
Engine. See Dental engine. Rotary steam engine.
Engines, dash pot for steam, H. Haberlin ... 449,878
Engines, journal box for steam, W. O. Webber ... 449,840
Engines off the dead center, device for throwing the cranks of, J. W. Freeman ... 450,009
Envelope making and printing machine, J. Ball ... 449,894
Exhibitor bedstead, Albin & Erdman ... 449,654
Explosives, process of and apparatus for making, H. S. Maxim ... 449,687
Eyeleting machine, G. Giglio ... 449,795
Fans, clutch for rotary, S. D. Shepperd ... 449,888
Fence, H. C. Chandler ... 449,667
Fence, J. Owens ... 449,745
Fence wire spool carrier and winder, H. Miller ... 450,030
Fencing, die for use in making barbed, J. H. Templin ... 450,044 to 450,049
Fencing, die for use in making barbed, E. Jordan, 450,077 to 450,079
File cutting machine, A. Shardlow ... 449,765
File, paper, A. Dom ... 450,097
Finger bar and guard finger, L. Miller ... 449,802
Fire alarm and extinguisher system, auxiliary, E. L. Slocum ... 449,829
Fire escape, W. H. McBeth ... 449,859
Fireplace heater, J. B. Oldershaw ... 449,692
Fishplate and nut, combined, Barrett & Copp ... 449,659
Flour, preparing, E. H. Dunn ... 449,794
Flushing device for water closets, etc., P. F. Britt ... 449,728
Forging car wheels, press for, W. A. Pearson ... 449,824
Frame. See Canvas stretcher frame. Quilting frame. Window frame.
Furnace. See Hot air furnace.
Furnace, D. H. Erdman ... 449,931
Furnace, J. Slimm ... 450,043
Furnace fire grate, L. Hopcraft ... 450,018
Furniture leg and frame therefor, detachable, C. A. Oveson ... 449,804
Gauge. See Saw gauge. Thermal gauge.
Game apparatus, F. H. Perry ... 450,108
Game apparatus, puzzle, G. B. Shepard ... 449,708
Garment supporter, G. C. Kibbe, Jr ... 449,817
Gas, apparatus for the manufacture of, C. Tellier ... 449,809
Gas burner attachment, P. Stephansky ... 449,712
Gas engines, vaporizer for, L. G. Wolley ... 450,091
Gas or water fittings, tool for operating on, S. J. Rofe ... 449,863
Gas tar or other liquid fuel, apparatus for burning, W. Bliss *et al* ... 450,052
Glass, apparatus for grinding, smoothing, and polishing, M. Malevez ... 449,686
Glass polishing machine, F. F. Fischer ... 449,816
Gold or silver from ores, apparatus for extracting, J. Cragg ... 449,813
Gold or silver from ores, extracting, J. Cragg ... 449,815
Gold or silver, lixiviation process of and apparatus for the extraction of, S. W. Cragg ... 449,814
Grate, L. L. Culver ... 450,058
Grate and flue, T. Rosser ... 450,040
Gravers while being ground, holder for, A. E. Francis ... 449,673
Grinding mill, L. D. Harding ... 450,014
Grip device, intermittent, H. L. Chapman ... 449,752
Guard. See Key hole guard.
Gun, breech-loading, B. W. Whitelaw ... 449,988
Hair and composition for use in the same, making ornaments, etc., from, M. I. Waldron ... 449,750
Hammer, H. B. Hackett ... 450,011
Handle and brush, combined, T. Russell ... 450,041
Hanger. See Door hanger.
Harmonica, M. Doertel ... 449,755
Harrow, A. G. Dewey ... 450,060
Harrow, C. S. Ruef ... 450,088
Harrow, disk, G. G. Crowley ... 449,871
Harrow or cultivator, side, Thompson & Parker ... 449,835
Harrow, rotary, I. E. Stump ... 449,833
Harvester, binder, Jones & Wedlake ... 450,024
Harvester, corn, B. Slusser ... 449,969
Harvesters, swathing attachment for, W. H. Sharpsteen ... 449,919
Hat trimming machine, S. T. Newman ... 449,911
Hay rack, J. C. Sellers ... 450,109
Hay tedder, E. D. & O. B. Reynolds ... 449,948
Heater. See Fireplace heater.
Heating by gas, apparatus for, W. Foulis ... 449,757
Hoisting machine, electrical, W. Baxter, Jr ... 449,661
Hoisting machines, differential mechanism for, G. F. Clemons ... 449,900
Holder. See Broom holder. Copy holder. Paper holder. Pillow sham holder. Rein holder. Tidy holder. Tool holder.
Hook. See Snap hook.
Hops, apparatus for disintegrating spent, E. Davies ... 450,059
Hose coupling, F. W. Wright ... 449,789
Hose coupling for street washers, G. W. Tinsley ... 449,838
Hot air furnace, J. B. Oldershaw ... 449,693
Huller. See Pea huller.
Ice cream freezer, D. C. Camp ... 449,665
Incandescent, O. B. Fahnehjelm ... 450,123
Incubator, N. L. Garrett ... 450,010
Index tab, J. Buscher ... 450,055
Inkstand, traveling, H. S. S. Fooks ... 450,066
Insects, composition for exterminating, A. O. Hagstedt ... 449,905
Insulator, L. McCarthy ... 449,943
Insulator pin machine, A. D. Catlin ... 449,773
Iron. See Sad iron.
Ironing machine, N. A. Ransom ... 449,702
Jack, W. Jackson ... 449,937
Journal bearing, M. Daley ... 450,004
Journal bearing, I. Hazelton ... 449,935
Journal bearing, H. H. Thorp ... 449,837
Journal bearing, anti-friction, M. A. Andrews ... 449,893
Keyhole guard, H. G. H. Reed ... 449,917
Knitting machine stripping mechanism, C. M. Musgrove ... 449,910
Knob, H. A. Matthews ... 449,908
Knob, door, W. H. Taylor ... 450,115
Ladder, self-raising, B. H. Burling ... 449,999
Ladder, step, A. Dormitzer ... 449,846
Lamp, O. Sweeney ... 449,978
Lamp, electric arc, Thomson & Rice, Jr ... 449,715
Lamp for street lighting, electric, H. H. Carpenter ... 450,000
Lamp support, electric, J. W. Easton ... 449,902
Lamp suspending device, F. H. Corthell ... 450,096
Land roller, Dodge & Starks ... 450,006
Lantern, signal, H. G. Griffith ... 449,736
Last, W. Gordon ... 449,877
Lathes, taper attachment for, Hazlet & Lord ... 450,016
Leather dressing machine, T. Shaw ... 449,707
Lens grinding machine, L. Reese ... 449,947
Letter box, G. D. Sidman ... 449,865
Level, plumb, C. A. C. Lasar ... 449,681
Lifer. See Load lifer. Transom lifter.
Light. See Search light.
Light by incandescence, producing, O. B. Fahnehjelm ... 450,099
Lightning arrester, J. W. Easton ... 449,908
Linotype machine, P. T. Dodge ... 449,872
Liquids, apparatus for delivering, S. Jenkins ... 449,778
Load lifter, R. Sargent ... 450,089
Lock. See Combination lock. Electrical lock. Nut lock.
Lock, J. Higbee ... 449,677
Lock, W. C. Smith ... 449,830
Locomotives, smoke consumer for, J. Player ... 449,826
Loom shuttle, R. Fox ... 449,932
Loom shuttle box operating mechanism, F. Lacey ... 449,742
Loom, swivel, H. Wyman ... 449,790
Lubricant, A. Grund ... 449,849
Measuring instrument for tunnels, H. R. M. Thom ... 449,920
Mechanical movement, Winlund & McSherry ... 450,122
Metal post, O. B. Hall ... 449,777
Metallic composition, making, E. J. Rollings ... 449,783
Meter. See Water meter.
Milk can, L. Koch ... 449,939
Milk cooler, J. F. Banks ... 449,992
Mill. See Grinding mill.
Mill appliance, H. Aiken ... 449,724
Mining machinery, conveyer and separator apron for, W. A. Merralls ... 449,942
Miter cutting machine, W. J. Perkins ... 449,696
Mould. See Basket mould. Candy mould. Type mould.
Monkey wrench, H. Haedicke ... 449,796
Mop and brush, convertible, W. H. Bagby ... 449,658
Nails, preparing wire, Pender & Purdy ... 449,861
Necktie, C. Goldthwait ... 449,775
Nozzle, exhaust, J. Player ... 449,825
Nut lock, A. C. Vaughan ... 449,983
Ordnance, breech-loading, E. Von Skoda ... 449,711
Ore concentrating machinery, C. M. Fitch ... 450,063
Ore concentrator, Hammond & Gordon ... 450,013
Ores magnetically, process of and apparatus for separating, Ball & Norton ... 449,726
Organ, reed, C. W. Egan ... 449,756
Packing for piston rods, metallic, W. Roadhouse ... 449,949
Pad. See Riding pad.
Painting, L. W. Osborn ... 450,087
Paintings and relief pictures, making combined smooth surface, O. J. R. Berner ... 449,727
Palmetto fiber, extracting, C. B. Warrand ... 450,120
Palmetto, manufacturing imitation horse hair from, C. B. Warrand ... 450,119
Pan. See Ash pan.
Paper and producing the same, illuminated embossed, P. Hake ... 449,675
Paper building material, S. H. Hamilton ... 449,737, 449,738
Paper holder and cutter, roll, L. Ehrlich ... 450,061
Paper holder and cutter, roll, C. K. Pickles ... 450,033
Paper holder and cutter, roll, G. Rein, 449,761, 449,762, 450,086
Paper holder and cutter, roll, Stewart & Livengood ... 449,784
Paste pot, H. Denney ... 449,670
Pavement, concrete, P. M. Bruner ... 450,054
Paving block, J. P. Hazelton ... 449,739
Pea huller, H. B. Babbitt ... 450,051
Pencil sharpener, W. S. Boyd ... 449,812
Pepsin, preparing, J. L. Webber ... 449,839
Photographic shutters, instantaneous, Dallmeyer & Beauchamp ... 449,733
Piano, A. Graff ... 449,933
Pillow sham holder, W. Johnston ... 450,075
Planter, corn, Hughes & Conner ... 450,019
Planter, corn, J. Kleihauer, Jr ... 450,026
Plaster or composition casts, mould for making, L. Napion ... 449,945
Plow, J. G. Hunt ... 449,978
Pocketbook, A. Y. Andrews ... 449,791
Pocketbook, F. Lieker ... 449,799
Post. See Metal post.
Post office lock box, M. Jackson ... 449,936
Pot. See Paste pot.
Potato digger, J. F. Fowler ... 450,008
Printer's chase, W. P. Harding ... 449,851
Printing presses, feed gauge for, E. L. Megill ... 449,909
Propeller, screw, M. G. Pool ... 449,862
Propeller, vessel, O. J. B. Boeselager ... 449,996
Protractor, C. S. Reamy ... 449,782
Puller. See Stump puller.
Pulley, W. L. Hall ... 449,676
Pump, sand, J. Braden ... 449,663
Punch, check, G. L. Banks ... 449,993
Puzzle, J. E. Jackson ... 449,881
Quilting frame, E. Martin ... 449,801
Rack. See Hay rack.
Radiator, sheet metal, H. A. Crossley ... 449,901
Railway chair, G. W. Wells ... 449,867
Railway crossing, cable, C. Vogel ... 450,117
Railway curve, cable, C. Vogel ... 450,118
Railway, electric, E. M. Bentley ... 449,792
Railway, electric, R. M. Hunter ... 449,797, 450,074
Railway signal, automatic, C. W. Wilhelm ... 449,990
Railway switch, S. B. Sabens ... 449,704
Railway trains, pneumatic signal for, G. A. Boyden ... 450,053
Railways, pole for overhead systems of electric, J. N. Brownlee ... 449,753
Railways, three-rail track for cable, C. Vogel ... 450,116
Register. See Counting register.
Regulator. See Draught regulator. Speed regulator.
Rein holder, W. Rene ... 449,763
Resawing maching, A. D. Catlin ... 449,772
Riding pad, W. C. McNeeley ... 449,860
Rivet, I. G. Platt ... 449,698
Rivets, forming, I. G. Platt ... 449,699
Rotary meters, fluid pressure device for, L. H. Nash ... 449,820
Rotary steam engine, J. E. Sackett ... 449,864
Roller. See Land roller.
Roller and seed sower, combined, T. A. Butler ... 449,754
Sad iron, E. G. Asmus ... 449,842
Sad iron, W. C. Dimmock ... 449,845
Saddle, gig, F. M. Friegel ... 450,067
Safe, portable coin, H. C. Hart ... 449,852
Sand, emery, or analogous paper or cloth, E. A. Dubey ... 449,930
Sandpapering head, Rogers & Gregor ... 449,950
Sash balance, A. Ingalls ... 450,021
Sash fastener, E. D. Bangs ... 449,895
Sash, window, A. Rudolph ... 449,764
Saw gauge, R. P. E. Vary ... 449,785
Saw guard, gang, K. Dolen ... 450,007
Saw guide, W. A. Campbell ... 449,844
Sawguide and rounder, Weaver & Thoma ... 449,984
Sawmill dog, W. H. Prouty ... 450,035
Scale attachment, J. A. Werner ... 449,986
Scale, cloth, A. J. Conen ... 450,009
Screen. See Bolting screen.
Screw, wood, C. D. Rogers ... 449,887
Seamer, metal roofing, I. Bales ... 449,775
Search light, electric, B. B. Ward ... 449,719
Seeds, composition for treating, J. Johann ... 449,741
Sewage, apparatus for treating, A. F. Black ... 450,094
Sewing machine, E. Kohler ... 449,818
Sewing machine, glove, E. B. Rudolph ... 449,926
Sewing machine shuttle, W. H. Latham ... 449,682
Sewing machines, leading-in device for overedge, E. B. Rudolph ... 449,927
Shade bracket, window, L. Harnish ... 450,070
Shutter worker, G. Andreen ... 449,656
Signal. See Railway signal. Train signal.
Signaling apparatus, W. S. Gilmore ... 449,674
Signaling apparatus, non-interference electrical, A. Newman ... 449,690
Slate attachment, M. Wyman ... 450,092
Slicer, grater, and beater, domestic, M. John ... 449,907
Smoke conductor, J. R. Johnson ... 450,093

Smoke consumer, J. Player 449,827
Snap hook, Buckingham & Yeates 449,870
Soldering tool, H. Beutelspacher 450,094
Spark arrester, E. J. Hadlock 450,012
Speculum, J. E. Lee 449,941
Speed governor, centrifugal, J. W. Brown 449,729
Speed regulator, A. B. Morse 449,688
Spike, C. E. Seymour 449,705
Spindle bands, take-up device for, T. Walker 449,810
Spool for textile machinery, J. E. Phillips 449,914
Spring. See Vehicle spring.
Stairs, metallic corner for, L. A. Howell 450,102
Stamp actuated by electro-magnets, time, W. B. Martindale 449,759
Stamp, hand printing, R. H. Smith 449,831
Stanchion for ships, J. H. Bell 449,994
Staple fastening machine, R. H. Little 449,779
Steam boiler, Vogt & Burns 449,922
Steel, crucible for the manufacture of, G. Nimmo 449,803
Steel, process of and apparatus for hardening hollow articles of, H. A. Brustlein 449,998
Stocking, R. M. Appleton 449,925
Stools or chairs, vertically-adjustable seat to, A. Nauts 449,689
Stopper. See Bottle stopper.
Stove, E. B. Colby 449,929
Stove, air heating, J. B. Oldershaw 449,691
Stove, gas, P. J. Grinberg 449,776
Stove leg attachment, J. B. Morse 449,819
Stove or range, C. V. Roberts 449,918
Stump puller, W. B. Morris 449,858
Sugar, apparatus for lixiviating, C. Steffen 449,976
Sugar from saccharine materials, apparatus for extracting, G. E. Patrick 449,747
Supporter. See Garment supporter.
Switch. See Railway switch.
Switch board, electrical, J. B. Lyon 449,685
Syringes, piston for, A. Molinari 449,883
Tack driving machine, M. G. Mains 450,027
Tanning, process of and composition for, C. B. Warrand 450,121
Tea kettle, J. L. Clark 449,899
Telegraphy, F. Anderson 449,655
Telegraphy, R. G. Brown 449,897
Telephony, multiple, W. W. Jacques 449,679
Thermal gauge, tracklayer's, P. H. Fontaine 450,065
Thrashing machine cutter and feeder, J. Eagleston 450,098
Thrashing machine feeding device, J. P. Monnett 450,084
Tidy holder, W. G. Browne 449,898
Tire for vehicle wheels, A. W. Thomas (r) 11,155
Tool holder, L. B. Nielsen 450,031
Tower and mast, F. L. Butler 449,730
Toy, E. P. Roberts 449,748
Toy bank, registering, Headley & Horton 450,071
Toy detonator, A. L. Seymour 449,706
Toy pistol, T. C. Murray 449,781
Toy swing, D. L. Keeler 449,938
Track clearer and lubricator, T. J. King 449,856
Track clearing and lubricating device, T. J. King 449,855
Train signal, Finn & Garner 449,672
Transom lifter, O. Lund 449,800
Trap. See Animal trap.
Tricycle, J. Carter 450,001
Truss, J. A. Rector 449,806
Tubs, mould for cement wash, J. Moore 449,884
Tug clip, hame, G. D. Stulken 449,714
Tug, thill, J. S. Hurley 449,906
Twines, etc., machine for the manufacture of, W. H. Avis 449,991
Type mould, Mitchell & Milne 450,083
Typewriting machine, T. Oliver 450,107
Typewriting machines, electrical, E. F. Youngs 449,923
Typewriting machines, type cleaning brush for, F. Van Fleet 450,126
Umbrella, T. J. Thorp 449,716
Valve and connection of wash basins and the like, waste and water pipe, J. R. Whiting 449,989
Valve controller, electric, G. E. Turner 449,889
Valve mechanism for carbonic acid gas generators, F. J. Johnston 450,076
Valve, steam actuated, J. H. Baker 449,868
Vehicle brake, automatic, A. F. George 450,100
Vehicle, spring, H. W. Pell 449,695
Vehicle spring, H. Timken 449,717
Vehicles, metallic end for, E. K. Bumpass 449,664
Vending machine, A. W. Roovers 449,749
Veterinary surgical instrument, J. W. Mullen 450,086
Vise, C. Wies 449,987
Wagon dump and elevator, J. S. Kidd 449,680
Wagon trains, connection for, W. H. Thurman 449,980
Waistband, F. Spitz 449,710
Wall paper, sales rack for, W. H. Eastman 449,734
Walls or ceilings, device for securing fixtures to, T. Wrigley 450,127
Washboard, C. H. Smith 449,972
Wash boiler, C. H. Fitzgerald 450,064
Washer. See Dish washer.
Washing machine, W. J. Bennington 449,995
Washing machine, W. H. Parker 449,694
Washing machine, K. F. Polk 449,700
Washing machine, Tacket & Raddas 449,834
Washing preparation, R. F. Halleck 449,879
Watch bow fastener, C. F. Morrill 449,885
Watch, stop, L. E. Piguet 449,915
Water closet tanks, operating valve in, W. H. Ward 449,770
Water closet tanks, water supply apparatus for, T. McHugh 449,994
Water closet valve, W. H. Ward 449,769
Water closets, water supplying apparatus for, W. H. Ward 449,768
Water elevator, automatic, H. R. Estes 450,062
Water meter, rotary, L. H. Nash 449,821
Welding, electric, E. Thomson 449,836
Well, tubular, Cameron & Chapman 449,771
Wheel. See Car wheel.
Wick raiser, B. P. Luce 450,106
Windmill, H. Noone 449,744
Window frame, Mesker & Arbegust 450,081, 450,082
Wire, machine for laying and spooling, Johnson & Hale 450,022
Wire stretcher, Springer & Jackson 449,803
Wood polishing machine, J. E. Carpenter 449,666
Wood polishing machine, J. L. Perry 449,697
Wrench. See Monkey wrench.
Wrench, C. H. Driver 449,793
Wrench, A. C. Whittier 449,722
Wringer. See Clothes wringer.

DESIGNS.

Advertising card, W. H. Spahr 20,663
Carpet button or fastener, stair, D. Walker 20,661
Cracker, etc., E. C. Pearson 20,662
Handle for spoons, etc., G. & B. W. Gooding 20,664
Spoon, E. C. Baumgras 20,665
Spoon, A. J. Dempsey 20,666
Spoon, etc., J. H. Johnston 20,668
Sugar bowl, etc., G. L. Crowell, Jr 20,667
Water closet bowl, C. A. Jaynes 20,659
Weighing machine case, H. E. Patterson 20,660

TRADE MARKS.

Alcohol, wood, J. A. & W. Bird & Co 19,278
Beer, Bavarian Brewing Co 19,306
Beer, O. S. Neale 19,310
Beer, lager, G. Gluek & Sons 19,307
Bicycles, Keefe & Becannon 19,296
Candy tablets, T. Candy 19,293
Chains, vest, D. C. Percival & Co 19,283
Cigars, S. Azcano y Meana 19,273
Cigars, J. Alvarez & Co 19,274
Cigars, V. Bustillo & Brother ..... 19,275 to 19,277
Cigars, J. Suarez y Gonzalez 19,285, 19,286
Cigars, Grommes & Ullrich 19,279
Cigars, J. Ybaseta ..... 19,287 to 19,289
Cigars, cigarettes, and manufactured tobacco, J. Gener 19,280
Diamonds, imitation, D. C. Percival & Co 19,284
Games, F. A. Kinney 19,282
Hose, textile fire, C. Callahan Company 19,292
Oil, illuminating, Tide Water Oil Company of Georgia 19,297
Organs, Hamilton Organ Comany 19,281
Paper bags, W. A. Chipman 19,295
Paper making materials, Liverpool Marine Store Co 19,308, 19,309
Remedy for diseases of the stomach, bowels, liver, ank kidneys, M. E. Welch 19,294
Steel plates, Bessemer, E. Davies & Sons 19,298
Thread, spool, J. Chadwick & Bro 19,290, 19,291
Tin, terne, and black plates and taggers, and Canada plates, Gwendraeth Tin Plate Company, 19,299 to 19,302
Tin, terne, zinc, and black plates, Redbrook Tinplate Company ..... 19,303 to 19,305

A Printed copy of the specification and drawing of any patent in the foregoing list or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated, the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

USE ADAMANT WALL PLASTER

It is **Hard, Dense, and Adhesive.** Does not *check or crack.* It is impervious to wind, water, and disease germs. It dries in a few hours. It can be applied in any kind of weather. It is in general use. Licenses granted for the mixing, using, and selling.

Address ADAMANT MFG. CO.
309 E. Genesee St.,
Syracuse, N. Y.

ICE-HOUSE AND COLD ROOM.—BY R G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, 59. Price 10 cents. To be had at this office and of all newsdealers.

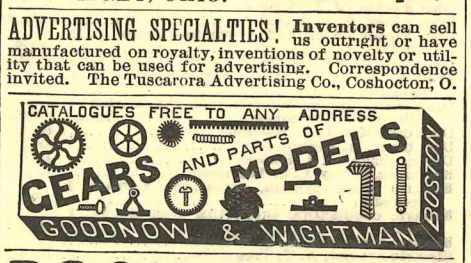
"Star" Foot Lathe Swings 9x25 in.
LATHE
Screw Cutting Automatic Cross Feed, etc.
LATHE
Scroll Saws, Circular Saws, Lathes Mortisers.
LATHE
Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 695 Water St., Seneca Falls, N. Y.

The Sebastian-May Co.
Improved Screw Cutting
Foot & Power **LATHES**

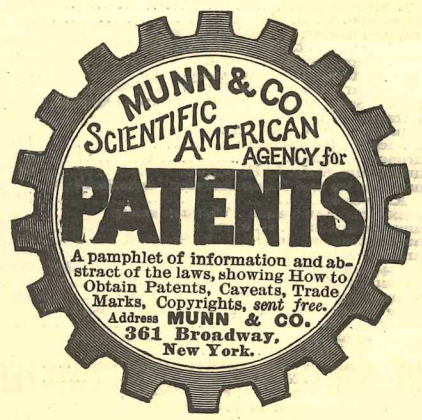
Drill Presses, Chucks, Drills, Dogs, and Machinists' and Amateurs' Outfits. *Lathes on trial.* Catalogues mailed on application.
165 to 167 Highland Ave., SIDNEY, OHIO.

ADVERTISING SPECIALTIES! **Inventors** can sell us outright or have manufactured on royalty, inventions of novelty or utility that can be used for advertising. Correspondence invited. The Tuscarora Advertising Co., Coshocton, O.



ROCK DRILLS
AIR COMPRESSORS,
MINING AND QUARRYING MACHINERY,
Ingersoll-Sergeant Drill Co.
No. 10 PARK PLACE, NEW YORK.
Send for Complete Priced Catalogue.

INVENTIONS WORKED OUT, Drawings and Models made. Perfect safety to inventors assured. All kinds first-class lathe, planer, and bench work. Particular attention to special machinery, tools, dies, and press work. Safety Construction Co., 143 & 145 Elm St., N.Y


MUNN & CO
SCIENTIFIC AMERICAN
AGENCY for
PATENTS
A pamphlet of information and abstract of the laws, showing How to Obtain Patents, Caveats, Trade Marks, Copyrights, *sent free.*
Address MUNN & CO.
361 Broadway,
New York.

Fine Taps, Dies, Reamers, Etc.

Lightning and Green River Screw Plates.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters, and other Labor Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., Greenfield, Mass.
New York Office, 126 Liberty Street.

TO BUSINESS MEN

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be overestimated. Its circulation is many times greater than that of any similar journal now published. It goes into all the States and Territories, and is read in all the principal libraries and reading rooms of the world. A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. This he has when he advertises in the SCIENTIFIC AMERICAN. And do not let the advertising agent influence you to substitute some other paper for the SCIENTIFIC AMERICAN, when selecting a list of publications in which you decide it is for your interest to advertise. This is frequently done, for the reason that the agent gets a larger commission from the papers having a small circulation than is allowed on the SCIENTIFIC AMERICAN.

For rates see top of first column of this page, or address **MUNN & CO., Publishers,**
361 Broadway, New York.

LIST OF BOOKS ON
ELECTRICITY

Alternate Current Transformer in Theory and Practice. Vol. I. The Induction of Electric Currents. 500 pages, fully illustrated and with copious index. By J. A. Fleming. 8vo, cloth. London, 1889.....$3.00
This book treats both practically and theoretically the subject of Electric Current Induction and the Alternating Current Transformer.

Arithmetic of Electricity. By T. O'Conor Sloane, A.M., E.M., Ph.D. This work gives Electric Calculations in such a simple manner that it can be used by any one having a knowledge of Arithmetic. It treats of calculations for wiring, resistance in general, arrangement of batteries for different work, and is supplemented by the most practical series of tables ever published. It is absolutely indispensable to the practical electrician, as well as to the amateur. Fully illustrated. 1891....$1.00

Art of Electrolytic Separation of Metals. By G. Gore. Theoretical and practical. Fully illustrated. 8vo, cloth. London, 1890.....$3.50

Dynamo. How to make a Dynamo. A Practical Treatise for Amateurs. Containing numerous illustrations, and detailed instructions for constructing a small dynamo to produce the electric light. By Alfred Crofts. 12mo, cl. London. Second edition. 1889..... .80

Electric Batteries. Elementary Treatise on. From the French of Alfred Niaudet, translated by L. M. Fishback. Fifth edition. N. Y., 1888.....$2.50

Electric Lighting. The Elements of Electric Lighting, including Electric Generation, Measurement, Storage, and Distribution. By Philip Atkinson, A.M., Ph.D., author of "Elements of Static Electricity." Contents: Electricity a Mode of Molecular Motion; Alternate Current Dynamos; Direct Current Dynamos; Electric Terms and Units; Electric Measurement; The Arc Lamp; The Incandescent Lamp; The Storage Battery; Electric Distribution, etc. Fourth edition. 260 pages. 104 illustrations. 1889.....$1.50
This is a very complete work, and should be in the hands of all who have to do with electric lighting apparatus of any kind whatever.

Electricity: The Science of the Nineteenth Century. A sketch for General Readers. By E. M. Caillard. Illustrated. 1891.....$3.00

Electricity. In Theory and Practice; or, the Elements of Electrical Engineering. By Lieut. Bradley A. Fiske. U. S. N. 258 pages, and many illustrations. 1888....$2.50

Electricity. The A B C of. An elementary manual giving in simple language a general outline of the science. 108 pages, with 36 illustrations. Wm. H. Meadowcroft. 12mo, cloth, 1889..... .50

Electricity in our Homes and Workshops. A practical Treatise on Auxiliary Electrical Apparatus. With numerous illnstrations. Sydney F. Walker. 12mo, cloth. London, 1889.....$1.50

Electrical Instument Making for Amateurs. By S. R. Bottone. A practical hand-book. Cloth, 175 pages, 59 illustrations..... .50

Electrical Rules and Tables. A pocketbook of Electrical Rules and Tables for the use of Electricians and Engineers. Revised and enlarged. 498 pages. 32mo, Roan. Sixth edition. 1889.....$2.50

Electricity and Magnetism. Elementary Lessons in Electricity and Magnetism. By Sylvanus P. Thompson. 171 illustrations and 442 pages. 1889.....$1.25

Electrical Dictionary. A Dictionary of Electrical Words, Terms, and Phrases. By Edwin J. Houston, A.M., Electrician of the International Electrical Exhibition. 640 pages and 396 illustrations. 1889.....$2.50
The author has aimed to give a concise definition of the word, term, or phrase, and a brief statement of the science involved in the definition, and to insert when possible, a cut of the apparatus described or employed in connection with the word, term, or phrase defined.

Electrical Engineering. By W. Slingo and A. Brooker. A Practical Book for Electric Light Artisans and Students. This is a Comprehensive Treatise on the more Important Modern Applications of Electricity. 630 pages. 300 illustrations.....$3.50

Electro-Motors, How Made and How Used. By S. R. Bottone. A Handbook for Amateurs and Practical Men. Illustrated. This book was originally prepared chiefly as letters, in reply to queries addressed to the Author on the construction of electro-motors, on their many modifications, and on their mode of workings. 12mo, cloth. London, 1890.....$1.20

Electro-Deposition. A Practical Treatise on the Electrolysis of Gold, Silver, Copper, Nickel, and other Metals and Alloys, with descriptions of Voltaic Batteries, Magneto and Dynamo Electric Machines, Thermopiles, and of the Materials and Processes used in every department of the Art, and several chapters on Electro-metallurgy. By Alexander Watt, author of "Electro-metallurgy," "The Art of Soap Making," etc., etc. With numerous illustrations. Third edition. Revised, corrected, and enlarged. London, 1889.....$3.50

Electricity for Engineers. By Charles Desmond. A Clear and Comprehensive Treatise on the Principles, Construction and Operation of Dynamos, Motors, Lamps, Indicators, and Measuring Instruments, also a Full Explanation of the Electrical Terms used in the work. Illustrated by nearly 100 Engravings, in 1 Volume. 12mo, 255 pages. Price.....$1.50

Electric Bells and All About Them. By S. R. Bottone. A Practical Book for Practical Men. With more then 100 Illustrations. 12mo, cloth. Price reduced to..... .50

Electric Light Installations and the Management of Accumulators. A Practical Handbook by Sir David Salomons, Bart., M. A., Assoc. Inst. C. E., member of Council of the Society of Telegraph Engineers and Electricians, member of the American Institute of Electrical Engineers. Fifth edition, revised and enlarged. With 99 illustrations. 348 pages. 12mo, cloth.....$1.50

Experimental Science. By Geo. M. Hopkins. Natural Philosophy without a Teacher Simplified. Interesting Experiments in Every Branch of Physics. Descriptions of Simple and Efficient Apparatus, much of which may be Made at Home. Among Subjects treated are Electricity in all its Branches, Magnetism, Heat, Light, Photography, Microscopy, Optical Illusions, Mechanics, etc. A world of Valuable Information. A Source of Rational Amusement. A superb work for Young and Old. 740 pages, nearly 700 first-class engravings. Elegantly bound in cloth.....$4.00

Incandescent Wiring Handbook. With 35 illustrations and 5 tables by F. B. Badt, late First Lieut. Royal Prussian Artillery, and author of "Dynamo Tenders' Handbook," "Bell Hangers' Handbook." 1889.....$1.00

Lectures on the Electro-Magnet. By Silvanus P. Thompson. Authorized American Edition. Just Published. Cloth.....$1.00

Practical Electric Bell Fitting. A Treatise on the Fitting-Up and Maintenance of Electric Bells, and all the necessary apparatus. By F. C. Allsop. With nearly 150 illustrations. 1889.....$1.25

Practical Electricity. A Laboratory and Lecture Course for First Year Studeuts of Electrical Engineering based on the Practical Definitions of the Electrical Units. By W. E. Ayrton, F.R.S. Nearly 500 pages, and 180 illustrations. Third edition. 1888.....$2.50

Practical Electrical Notes and Definitions.—For the use of Engineering Students and Practical men. By W. Perren Maycock, A.M. Inst. E. E. Second edition, revised and enlarged. 286 pages, with illustrations. 32mo, roan.....$1.75

Practical Electrics.—A Universal Hand-book on every-day electrical matters, including connections, alarms, batteries, bells, carbons, induction, intensity and resistance coils, dynamo-electric machines, fire risks, measuring, microphones, motors, phonographs, photophones, storage and telephones. Being the Electrical portion of the "Third Series of Workshop Receipts." 135 pages, 12mo, cloth. 1890..... .75

Telephone.—The Electric Telephone. By George B. Prescott. Second edition, revised and enlarged. 512 illustrations. 790 pages. 1890.....$6.00

The Electrical Engineer's Pocket Book. Modern Rules, Formulæ, Tables, and Data. By H. R. Kempe. 32mo, leather. London, 1890.....$1.75

The Telephone. By Wm. H. Preece and Julius Maier, Ph.D. 30 chapters, 290 illustrations, and 482 pages. 1889.....$4.00

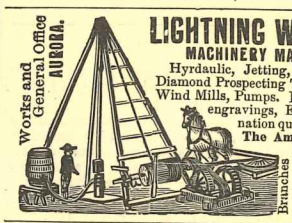
Voltaic Accumulator. The Voltaic Accumulator, an elementary treatise, By Emile Reynier. Translated from the French by J. A. Body. 1889.....$3.00

☞ Any of the above books promptly sent by mail, postpaid, on receipt of the price, by

MUNN & CO.,
Publishers of the "Scientific American,"
361 Broadway, New York.

☞ *Send for our New and Complete Catalogue of Books, sent free to any address.*

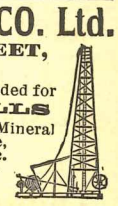
ELECTRICAL!
Just out. Finely finished and Effective Desk Fan Motor. Continuous High Speed with Primary Battery. Motor and Battery, $10.00. Discount to Dealers.
NOVELTY ELECTRIC CO., 54 North 4th St., Phila., Pa.



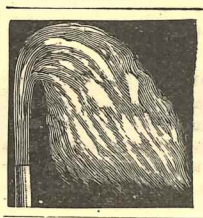
LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.
Hyrdaulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. **Encyclopedia,** 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c.
The American Well Works, Aurora, Ill.
Branches { 11 & 13 S. Canal St., Chicago, Ill.
Dallas, Texas.

OIL WELL SUPPLY CO. Ltd.

91 & 92 WATER STREET,
Pittsburgh, Pa.,
Manufacturers of everything needed for
ARTESIAN WELLS
for either Gas, Oil, Water, or Mineral Tests, Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. Illustrated catalogue, price lists and discount sheets on request.



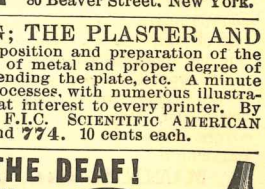
A HYDRAULIC OR JET-PROPELLED Steam Lifeboat.—Description of a naval lifeboat propelled by a jet of water, with full details and account of the main features of construction and of the trials made of it for maneuvering power. With 4 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 770. Price 10 cents. To be had at this office and from all newsdealers.



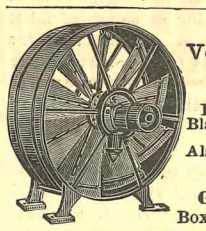
ARTESIAN
Wells, Oil and Gas Wells, drilled by contract to any depth, from 50 to 3000 feet. We also manufacture and furnish everything required to drill and complete same. Portable Horse Power and Mounted Steam Drilling Machines for 100 to 600 ft. Send 6 cents for illustrated catalogue. **Pierce Artesian and Oil Well Supply Co.,** 80 Beaver Street, New York.

STEREOTYPING; THE PLASTER AND Paper Processes.—Composition and preparation of the mould, the best alloys of metal and proper degree of heat, trimming and mending the plate, etc. A minute description of both processes, with numerous illustrations. A paper of great interest to every printer. By Thomas Bolas, F.C.S., F.I.C. SCIENTIFIC AMERICAN SUPPLEMENTS, 773 and 774. 10 cents each.

A BOON TO THE DEAF!

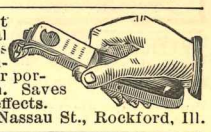


Osgood's No. 1 Hearing Horn is the only instrument that will help the deaf. Made from best bell metal, and will last for years. Carried in the pocket and used in public without attracting attention. Price $5. Sent C. O. D. May be returned after 2 weeks' trial if not found satisfactory.
OSGOOD BROS., Cor. 7th St. & Broadway, Oakland, Cal.



CLARK'S
Ventilating and Drying
FANS.
Light Running, Adjustable Blades, Self-Oiling Bearings.
24-page catalogue free.
Also Rubber Press Rolls for Wool and Yarn Washing and Dyeing Machines.
GEO. P. CLARK, Manuf.
Box L, Windsor Locks, Ct.

AIR BRUSH Highest gold medal award by Franklin Institute as a legitimate Art Tool. Invaluable to crayon and water color portrait artists and draughtsmen. Saves time, gives finest technical effects.

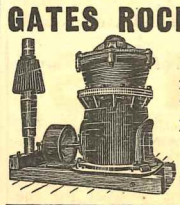


AIR BRUSH MFG. CO., 67 Nassau St., Rockford, Ill.

CUSHMAN CHUCKS
Complete line for all uses shown in new illustrated catalogue, *free to all.*
Cushman Chuck Co., Hartford, Conn.

THE DAIMLER MOTOR
THE DAIMLER MOTOR CO.
is prepared to furnish **1, 2,** and **4 Horse Power**
GAS or PETROLEUM MOTORS
for all Industrial Purposes. *Fully illustrated catalogue and price list on application.* Motors in operation at Works, Steinway, Long Island City.
Office, 111 East 14th Street, New York City.

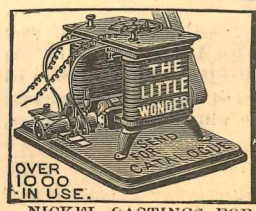
GATES ROCK & ORE BREAKER



Capacity up to 200 tons per hour.
Has produced more ballast, road metal, and broken more ore than all other Breakers combined.
Builders of High Grade Mining Machinery.
Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
215 Franklin St., Boston, Mass.

$3 PRINTING PRESS. Do all your own printing. Save money. Catalogue for two stamps. **Kelsey & Co.,** Meriden, Conn.

THE PENNA. DIAMOND DRILL & MFG. CO.
BIRDSBORO, PA., Builders of High Class Steam Engines, Diamond Drilling and General Machinery. Flour Mill Rolls Ground and Grooved.



NICKEL AND ELECTRO-PLATING APPARATUS & MATERIAL
THE HANSON & VAN WINKLE Co
NEWARK, N. J.
81 LIBERTY ST. N.Y.
23 S. CANAL ST. CHICAGO
NICKEL CASTINGS FOR ALL PURPOSES.

Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞Our new and Revised Catalogue of Practical and Scientific Books, 86 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

☞ Send a postal card to the publishers for NEW ILLUSTRATED SCIENTIFIC CATALOGUE mailed free to any address.

J. B. LIPPINCOTT COMPANY, 715–717 Market Street, Philadelphia.

ARCHITECTURAL BOOKS.

Useful, Beautiful, and Cheap.

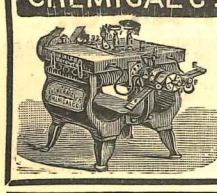
To any person about to erect a dwelling house or stable, either in the country or city, or any builder wishing to examine the latest and best plans for a church, school house, club house, or any other public building of high or low cost, should procure a complete set of the ARCHITECTS' AND BUILDERS' EDITION of the SCIENTIFIC AMERICAN.

The information these volumes contain renders the work almost indispensable to the architect and builder, and to persons about to build for themselves they will find the work suggestive and most useful. They contain colored plates of the elevation, plan, and detail drawings of almost every class of building, with specification and approximate cost.

Nine bound volumes are now ready and may be obtained, by mail, direct from the publishers or from any newsdealer. Price, $2.00 a volume. Stitched in paper covers. Subscription price, per annum, $2.50. Address and remit to

MUNN & CO., Publishers,
361 Broadway, New York.

NICKEL PLATING
& POLISHING MATERIALS.
ZUCKER & LEVETT
CHEMICAL Co NEW YORK U.S.A.



NICKEL ANODES,
NICKEL SALTS,
ROUGES,
COMPOSITION,
BUFFING WHEELS,
ELECTRO & NICKEL PLATING OUTFITS.

WORKING LOCOMOTIVES WITH Petroleum Fuel.—By Thomas Urquhart. An interesting account of the recent results of the author's experience in the use of petroleum refuse as fuel on an unprecedented scale upon the Grazi & Tsaritsin Railway, Southeast Russia. With 52 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **769** and **770**. Price ten cents each. To be had at this office and from all newsdealers.

Barnes' Foot-Power Machinery

Complete outfits for Actual Worksnop Business. A customer says: "Considering its capacity and the accuracy of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day, and at night feel as little tired as if I had been walking around." Descriptive Price List Free.

W. F. & JOHN BARNES CO.,
1999 RUBY ST., Rockford, Ill.

NEW YORK TRADE SCHOOLS.—DESCRIPTION of the New York Trade Schools which were established nine years ago for the purpose of giving instructions to young men in certain trades, and to enable young men already in such trades to improve themselves. With 10 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **781**. Price 10 cents. To be had at this office and from all newsdealers.

OUR MAGIC LANTERNS WITH OIL LAMPS HAVE NO EQUAL
VIEWS OF ALL SUBJECTS
EASTERN PRICES GUARANTEED
SEND FOR CATALOGUE
L. MANASSE
88 MADISON ST CHICAGO ILL

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for inventors.

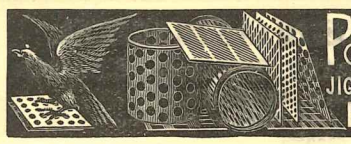
In this line of business they have had *forty-one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues Infringements, Assignments, Rejected Cases. Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.
BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

DEAFNESS & HEAD NOISES CURED by Peck's Invisible Tubular Ear Cushions. Whispers heard. Successful when all remedies fail. Sold only by F. Hiscox, 853 B'way, N.Y. Write for book of proofs **FREE**



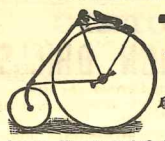
PERFORATED METALS for MINING SCREENS, COAL AND ORE SEPARATORS, REVOLVING AND SHAKING SCREENS, JIGS & STAMP BATTERIES FOR ALL KINDS OF MILLING & MINING MACHINERY, & ALL OTHER USES
HARRINGTON & KING PERFORATING Co. CHICAGO.
NEW YORK OFFICE, 284 PEARL STREET

ELECTRO MOTOR. SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **641**. Price 10 cents. To be had at this office and from all newsdealers.

The most Successful Lubricator for Loose Pulleys in use.
VAN DUZEN'S PATENT LOOSE PULLEY OILER
Highly recommended by those who have used them for the past four years. Prices very reasonable. Every user of machinery should have our "Catalogue No. 56," sent free. Mention this paper.
VAN DUZEN & TIFT, Cincinnati, Ohio.

FOR RENT

In the best Natural Gas City in Indiana, Buildings with Heat, Light, and Power. Equipped with Automatic Sprinklers, Steam Heat, and Electric Light, suitable for light or heavy manufacturing. Address,
JAS. BOYCE, MUNCIE, IND.



THE EAGLE
THE EASIEST RUNNING BICYCLE IN THE WORLD.
☞Speed, Comfort and Safety.
AGENTS WANTED.
Large Illustrated Catalogue sent Free to any Address.
THE EAGLE BICYCLE MFG. CO.,
STAMFORD, CONN.

ARTIFICIAL INCUBATION.—A DESCRIPTION of the French process of raising chickens. With 7 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **778**. Price 10 cents. To be had at this office and from all newsdealers.

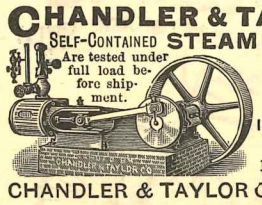
Barrel, Keg, Hogshead AND STAVE MACHINERY.
Over 50 varieties manufactured by
E. & B. Holmes,
BUFFALO, N. Y.
Truss Hoop Driving.
ALSO A FULL LINE OF WOOD WORKING MACHINERY.

WANTED. Selling Agents for Electrical Novelties. Battery Motors surprise electrical experts. Stamp for catalogue, $10 per day made. BUSH CO., 24 Park Place, New York.

PHOTOGRAPHY!

Our Latest Novelties for the Amateur are
KNACK CAMERAS,
MASCOT CAMERAS,
TRIAD CAMERAS,
Waterbury Detective Cameras,
Irving View Cameras, and
Magazine Cameras for Films.
THE SCOVILL & ADAMS CO.,
423 Broome Street, New York.

CHANDLER & TAYLOR CO'S STEAM ENGINES



Self-Contained. Are tested under full load before shipment.
12 TO 80 H. P.
IN STOCK FOR QUICK DELIVERY.
For Catalogue "S," address
CHANDLER & TAYLOR CO., INDIANAPOLIS, IND.

CHUCK AND MICROMETER STOP for Amateurs.—By C. D. Parkhurst. Description of a simple and easily constructed chuck for use with a dividing machine, and the micrometer stop that is used to regulate the depth of the cut in the graduation of circles, etc. With 9 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **772**. Price 10 cents. To be had at this office and from all newsdealers.

The Caligraph.
LIFE IS TOO SHORT TO WRITE THE OLD WAY
Address: The American Writing Machine Co., Hartford, Conn.; New York Office, 237 Broadway.

FOREIGN BUSINESS!

Specialties in Machinery of all kinds wanted to place in the English, German, and French markets. Good English, German, and French Patents Bought. Our Representative will leave for England about May 15th.

Address **LARMACO**, BOSTON, MASS.

DEVELOPMENT OF AMERICAN Blast Furnaces, with special reference to large Yields.—By James Gayley. A description of some of the principal blast furnaces in the United States, showing the changes in design and practice by means of which extraordinarily large yields have been obtained in the last decade. With 8 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **776**. Price 10 cents. To be had at this office and from all newsdealers.

CUTLER DESK. BEST IN THE WORLD.
A. CUTLER & SON,
BUFFALO, N.Y., U.S.A.

NATIONAL STEEL TUBE CLEANER

RANKS THE HIGHEST
Endorsed by the best Engineers.
CHALMERS-SPENCE CO.
Office, 59 Liberty St., New York.

ELECTRIC POWER TRANSMISSION in Mining Operations.—By H. C. Spaulding. A brief presentation of some of the work already done toward the application of electrical apparatus to mining processes, with some practical suggestions and statements from those who have had personal experience in the operations of such apparatus. With 2 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **783**. Price 10 cents. To be had at this office and from all newsdealers.

ALANSON CARY
MANUFACTURER OF FLAT STEEL SPRINGS OF EVERY DESCRIPTION
240 & 242 W. 29TH ST. NEW-YORK.

Useful Books!

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published for free circulation at the office of this paper. Subjects classified with names of author. Persons desiring a copy, have only to ask for it, and it will be mailed to them. Address,
MUNN & CO., 361 Broadway, New York.

THE LONDON ELECTRIC UNDERground Railway. Description of the plan followed methods of work, and use of the hydraulic shield. With 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **771**. Price 10 cents. To be had at this office and from all newsdealers.

SAVE MONEY ON
BICYCLES
By sending to **A. W. GUMP & CO.** Dayton, Ohio, for list. *Bicycles, Guns, and Typewriters* **taken in exchange.**
Difficult Repairing. Over **1200 Cycles in stock.** Here are samples:

	Cost.	*Price.*
Broncho Safety, new,	$135.	$100.
Am. Rambler, good as new,	125.	85.
Men's Safety, 30 in., ball bearings, new,	90.	55.
Boy's Safety, 24 in., rubber tires, new,	25.	20.

BLUE PRINT Paper, Superior Quality. Photographic Supplies. Send for catalogue.
T. H. McCOLLIN & CO., 1030 Arch Street, Philadelphia.

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116**. Price 10 cents. To be had at this office and of all newsdealers.

GASOLINE and GAS ENGINES

Our new Engines are hustlers. A 6 x 7 inch Engine, now running 100 feet of shafting. Boring Mills, Planers, Lathes, Drill Presses and Milling Machines for 20 Machinists, on 6 gal. Gasoline per day, costing only 60 cts. Write for information. *Mention this paper.*

Van Duzen Gas & Gasoline Engine Co.
CINCINNATI, OHIO.

ON GAS ENGINES.—A VALUABLE paper by E. Delamare-Debouteville, touching upon the history of gas motors in general, and describing in detail the "Simplex" engine invented by the author and Mr Malandin. With 23 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **715** and **716**. Price 10 cents each. To be had at this office and from all newsdealers.

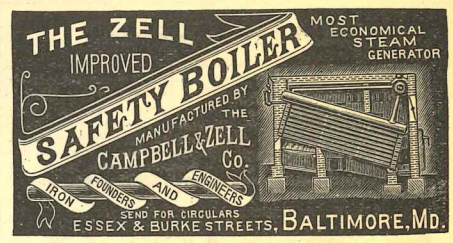
A Machine Shop and Laboratory
Where inventors may be helped out of their mechanical troubles. Will send a primer that is itself a help.
THE JONES BROTHERS ELECTRIC CO. CIN'TI, O.

"Improvement the order of the age."
THE SMITH PREMIER TYPEWRITER

Important Improvements.
All the Essential Features greatly perfected.
The Most Durable in Alignment.
Easiest Running and Most Silent.
All type cleaned in 10 seconds without soiling the hands.
The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.
Send for Catalogue.

THE PHONOGRAPH.—A DETAILED description of the new and improved form of the phonograph just brought out by Edison. With 8 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **632**. Price 10 cents. To be had at this office and from all newsdealers.

TYPEWRITERS, ALL MAKES, NEW & SECOND HAND — BOUGHT, SOLD AND EXCHANGED. NATIONAL TYPEWRITER EXCHANGE, ALSO RENTED ANYWHERE IN THE U.S. 200 LA SALLE ST. CHICAGO. GET OUR PRICES BEFORE BUYING. NEW CATALOGUE ON APPLICATION.



PROPOSALS.

PROPOSALS FOR MAIL-BAG CORD-FASTENERS AND FOR IRON AND STEEL, &c., FOR POST OFFICE DEPARTMENT.

POST OFFICE DEPARTMENT, WASHINGTON, D. C., February 28, 1891.—Sealed proposals will be received at this Department until noon, on Wednesday, the sixth day of May, 1891, for furnishing, according to contract, Mail-bag Cord-fasteners, Iron, Steel, Brass, Oils, and Waste. All proposals must be in accordance with the specifications, which can be obtained from the Second Assistant Postmaster General, Mail Equipment Division.
JOHN WANAMAKER, *Postmaster General.*

BERMUDA.

NOTICE TO ENGINEERS, CONTRACTORS, Etc.

Sealed tenders for deepening the channels leading into Hamilton Harbor, Bermuda, will be received at the Office of the Colonial Secretary, Hamilton, Bermuda, up to 12 o'clock noon of

TUESDAY, THE 14TH OF JULY, 1891.

Tenders to be sent in in duplicate, and to be marked on the covers, "Tender for Channel Improvements."

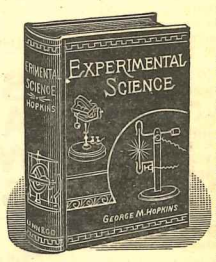
Complete plans of the work may be seen, and specifications, conditions of contract, forms of tender, and printed information regarding the work may be obtained at the office of the Crown Agents for the Colonies, Downing Street, London; at the office of Her Britannic Majesty's Consul General at New York; and at the office of the Colonial Surveyor, Hamilton, Bermuda.

The Government of Bermuda will not be bound to accept the lowest or any other tender.

W. CARDY HALLETT, *Colonial Surveyor.*
HAMILTON, Bermuda, March, 1891.

Experimental Science

BY
Geo. M. Hopkins.



Interesting Experiments in Every Branch of Physics. Descriptions of Simple and Efficient Apparatus, much of which may be Made at Home. Among Subjects treated are Electricity in all its Branches, Magnetism, Heat, Light, Photography, Microscopy, Optical Illusions, Mechanics, etc. A world of Valuable Information. A Source of Rational Amusement. A superb work for Young and Old.

Illustrated Circular and Table of Contents sent free.
740 PAGES. 680 ILLUSTRATIONS.
PRICE, by mail, postpaid, - - - $4.00.
MUNN & CO., Publishers,
Office of THE SCIENTIFIC AMERICAN,
361 Broadway, New York.

STEAM ENGINE. HOW TO MANAGE. By J. C. S.—A very practical paper on the subject. How to fire with wood and coal, how to manage the water supply, how to clean the engine, how to clean the supply pipe, how to gauge the pump, etc. With 12 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **747**. Price 10 cents. To be had at this office and from all newsdealers.

INCOMBUSTIBLE MACHINERY WIPING MATERIAL. Much cheaper and better than Cotton Waste. Consumers and dealers should write for particulars to
BORDEN & REMINGTON, Fall River, Mass., U. S. A.

STEEL TYPE FOR TYPEWRITERS

Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks., 100 Nassau St., N.Y

ECONOMICAL APPARATUS.—BY W. H. Ince, Ph.D. Descriptions of apparatus which can be easily made by any one who possesses a certain amount of ingenuity and mechanical skill—blow pipes, Bunsen burners, steam apparatus, chemical apparatus. With 20 figure. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **780**. Price 10 cents. To be had at this office and from all newsdealers.

Cheap Printing Do it yourself. Circular press $8. Size for small newspaper, $44. Everything easy, printed rules. Send two stamps for Catalogue to factory. **KELSEY & CO., Meriden, Conn.**

SMOKELESS EXPLOSIVES.—A LECture by Sir Frederick Abel, F.R.S., treating of the production of explosives for rapid firing guns, and giving an account of the work of inventors in this line of research. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **745**. Price 10 cents. To be had at this office and from all newsdealers.

PATENT FOR SALE. SELF-HEATING SAD IRON. Agents look here! 158 dozen sold in one County If you want a rapid seller with big profits, write to
H. S. PEASE, 171 Elm Street, Cincinnati, Ohio.

WILL SELL United States, British, French, Austria-Hungarian, and Belgian patents on a valuable invention for $1,000. Address Box 243, North Collins, New York.

The Scientific American

PUBLICATIONS FOR 1891.

The prices of the different publications in the United States, Canada, and Mexico are as follows:

RATES BY MAIL.

The Scientific American (weekly one year	$3.00
The Scientific American Supplement (weekly), one year.	5.00
The Scientific American, Spanish Edition (monthly) one year,	3.00
The Scientific American, Architects and Builders Edition (monthly), one year.	2.50

COMBINED RATES.

The Scientific American and Supplement,	$7.00
The Scientific American and Architects and Builders Edition,	5.00
The Scientific American, Supplement, and Architects and Builders Edition,	9.00

Proportionate Rates for Six Months.

This includes postage, which we pay. Remit by postal or express money order, or draft to order of
MUNN & CO., 361 Broadway, New York.

Advertisements.

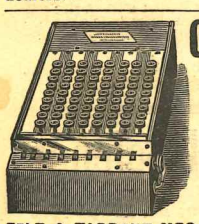
Inside Page, each insertion - - - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line.

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

VICTORS
MAKE THE PACE
HIGHEST GRADE
CATALOGUE FREE

OVERMAN WHEEL CO., MAKERS,
CHICOPEE FALLS, MASS.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.
A. G. SPALDING & BROS.
SPECIAL AGENTS,
CHICAGO. NEW YORK. PHILADELPHIA.

ALUMINUM. AN INTERESTING DESCRIPTION of the various methods of manufacturing this metal, chemical and electrolytic; with special reference to the Heroult method. With 6 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **753.** Price 10 cents. To be had at this office and from all newsdealers.

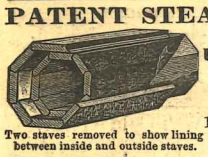


COMPTOMETER
(TRADE MARK.)
ALL ARITHMETICAL PROBLEMS
Solved rapidly and accurately by using the COMPTOMETER. Saves **40 per cent.** of time. Entire relief from mental strain. Adapted to all commercial and scientific computations. Send for circular.
FELT & TARRANT MFG. CO., 52-56 Illinois St., Chicago.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's ☞ Book of **SAWS**, new 1890 edition. We are first to introduce NATURAL GAS for heating and tempering **Saws** with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address **EMERSON, SMITH & CO. (Ltd.), Beaver Falls, Pa.** **SAWS**

MACHINE TOOLS
Engine Lathes, Planers, Shapers, Turret Lathes, etc. ☞ *Send for Catalogue.*
The Hendey Mach. Co., Torrington, Conn.

PATENT STEAM-PIPE CASING
—FOR—
Underground Steam Pipes



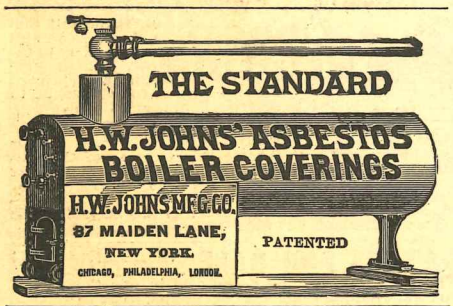
Two staves removed to show lining between inside and outside staves.

A. WYCKOFF & SON,
116 East Chemung Place,
ELMIRA, N. Y.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.



Scientific Book Catalogue
RECENTLY PUBLISHED.
Our new catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., Publishers Scientific American,
361 Broadway, New York.

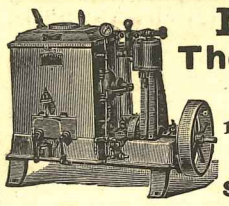
NEW KODAKS

"You press the button, we do the rest."

Seven New Styles and Sizes

ALL LOADED WITH
Transparent Films.

For sale by all Photo. Stock Dealers.
THE EASTMAN COMPANY,
Send for Catalogue. *ROCHESTER, N. Y.*



NO SKILLED ENGINEER.
The Shipman Automatic Steam Engine
STATIONARY AND MARINE.
Petroleum, Kerosene Oil, and Natural Gas Fuel.
1, 2, 4, 6, and 8 Horse Power, Single.
8 and 22 Horse Power, Compound
For Elevating Water, Creameries, and all Manufacturing Purposes.
SHIPMAN ENGINE CO., 210 Summer St., BOSTON

KOCH'S DISCOVERIES.—A FULL ACcount of Dr. Koch's remedy for tuberculosis, the method of using it, etc. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **782.** Price 10 cents. To be had at this office and from all newsdealers.

SEAMLESS BRASS & COPPER TUBES, SHEET BRASS BRASSWIRE
FINE TOOLS FOR DENTISTS, CHEMISTS, JEWELERS, ETC.
SEND FOR CATALOGUE
175-177 LAKE ST. CHICAGO.

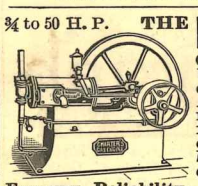
"COLUMBIAS"
HIGHEST GRADE ONLY.
CATALOGUE FREE

POPE MFG. CO., 77 Franklin Street, BOSTON.
Branch Houses: 12 Warren St., NEW YORK, 291 Wabash Ave., CHICAGO. Factory, HARTFORD, CONN.

PAINT YOUR ROOFS
WITH
DIXON'S SILICA GRAPHITE PAINT
Water will run from it pure and clean. It covers double the surface of any other paint, and will *last four or five times longer.* Equally useful for any iron work. Send for circulars. JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

PATENT JACKET KETTLES
Plain or Porcelain Lined.
Tested to 100 lb. pressure. Send for Lists.
BARROWS-SAVERY CO.,
8 Front & Reed Streets, Philadelphia, Pa.

STEREOTYPING.—A VALUABLE series of lectures by Thomas Bolas, discussing the most recent methods in this branch of typography. With 23 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **773** and **774.** Price 10 cents each. To be had at this office and from all newsdealers.



¾ to 50 H. P. **THE Motor of 19th Century**
Can be used *Any Place*, to do *Any Work*, and by *Any One*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address
Economy, Reliability, Simplicity, Safety. **CHARTER GAS ENGINE CO. P. O. Box 148, Sterling, Ill.**

If you want the **SIMPLEST** and **BEST**

GATE VALVE
for low pressures (below 60 lbs.) whether for Steam, Gas, Water, Oils, or Thick Fluids, investigate the "Handy." It is more compact and costs much less than any other Gate Valve. Write for Catalogue.
The Lunkenheimer Brass Mfg. Co.
15-17 E. 8th St., Cincinnati, O.

WORKING MODELS and **Experimental Work.** New inventions worked out. Small machinery built in iron or brass. Working drawings made. Aug. Zaubitz, 48 Centre St., N.Y.

ELECTRIC PERCUSSION DRILLS
Marvin System of Percussion Tools.
Drill contains no commutator nor moving contacts.
All circuits are protected in closed metallic cases.
More economical, simpler, and more easily handled than steam or air drills.
Safe and reliable. Not affected by moisture, dampness, or dripping water.
Weight of drill, with tripod, about 400 pounds.
Speed of drilling in hard granite, 2 in. hole, 2 inches per minute.
Send for descriptive pamphlet and prices.
Edison General Electric Co.
Edison Building, Broad St., New York.

GYMNASTICS FOR GIRLS.—AN INteresting account of the course of instruction given at the Berkeley Athletic Club for Ladies. With 18 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **753.** Price 10 cents. To be had at this office and from all newsdealers.

MOSS ENGRAVING COMPANY
535 PEARL ST. COR. ELM NEW YORK
MOSS-TYPE PHOTO ENGRAVING ZINC ETCHING
OUR PROCESSES — WE DO FINE PRESS WORK

Engravings direct from photographs and other copy. Our circular "N" shows specimens. Fine printing a specialty.

THE "FISHKILL" CORLISS ENGINE
COMBINING A MAXIMUM OF ECONOMY, EFFICIENCY, AND DURABILITY.
Fishkill Landing Machine Co., Fishkill-on-Hudson, N. Y.

Wonderful Electrical Invention

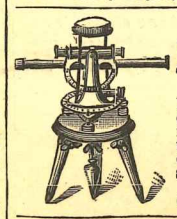
(Size 1½ x 7 inches.)

Found after years of study. A reliable battery for medical purposes. Without acids, paste, or plates. No recharging, always ready. Mild or powerful. Electricity will cure when all other remedies fail. Price, $8.00. We want agents everywhere. A fortune in every State. Particulars and terms for stamp.
C. DORAN STONE & CO.
Sole Agents, CHICAGO.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made; how to apply the written letter to the pad; how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **438.** Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

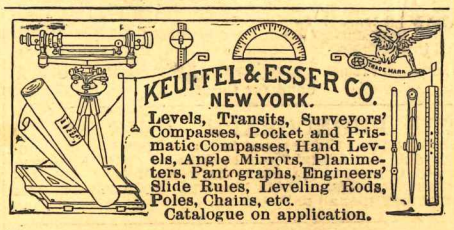
MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS FINE TINNING, JAPANNING AND FINISHING
THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA.

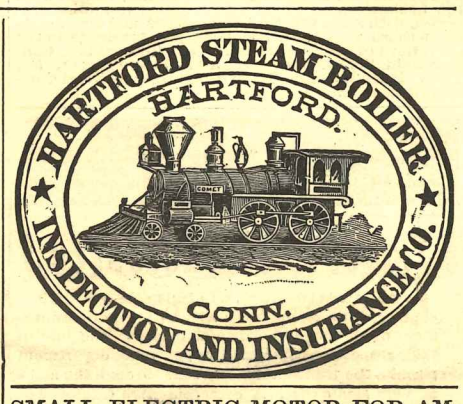
2nd MACHINERY Lists Sent.
N. Y. Mach'y Depot, Bridge Store 16. Frankfort St., N.Y.



HARMON'S IMPROVED
Leveling Instrument.
With or without Compass.
For Engineers, Contractors, and all others requiring a low price Leveling Instrument for grading, measuring heights, squaring, or getting any desired angle. Illustrated circular sent on receipt of stamp.
JOHN W. HARMON,
65 Haverhill St., Boston, Mass.

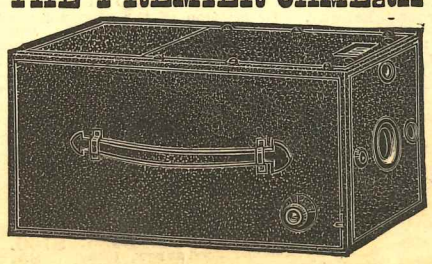
SEWING MACHINE MOTOR FOR AMAteurs.—By C. D. Parkhurst. Description of a very simple and effective motor, with laminated armature, of sufficient power to actuate a sewing machine. With 11 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **759.** Price 10 cents. To be had at this office and from all newsdealers.


KEUFFEL & ESSER CO.
NEW YORK.
Levels, Transits, Surveyors' Compasses, Pocket and Prismatic Compasses, Hand Levels, Angle Mirrors, Planimeters, Pantographs, Engineers' Slide Rules, Leveling Rods, Poles, Chains, etc.
Catalogue on application.



SMALL ELECTRIC MOTOR FOR AMateurs.—By C. D. Parkhurst. Description in detail of a small and easily made motor powerful enough to drive a ten or twelve inch brass fan and to give a good breeze. With 15 figures drawn to a scale. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **767.** Price 10 cents. To be had at this office and from all newsdealers.

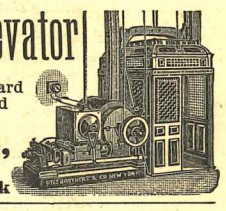
THE PREMIER CAMERA



IS THE BEST IN MARKET.
Simple of Manipulation.
Plates or Films are used.
The Shutter is always set.
PRICE $18.00.
Send for Catalogue and copy of Modern Photography.
ROCHESTER OPTICAL COMPANY,
14 S. Water St., ROCHESTER. N. Y.

THE FRED'K CRANE CHEMICAL CO.
SHORT HILLS, N. J.-BOX 91A-
ZAPONS, BRUSH & DIP. LACQUERS, VARNISH. SHELLACS, BLACKS, BRILLIANT & DEAD. JAPANS, AIR DRYING ENAMELS, TRANSPARENT, FOR METAL AND WOOD. PROOF AGAINST ACIDS AND ALKALIES. —WRITE FOR CATALOGUE.—

Otis Electric Elevator
—ALSO—
Manufacturers of the Standard Hydraulic Passenger and Freight, Steam and Belt
ELEVATORS,
Otis Brothers & Co.,
38 Park Row, New York



SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

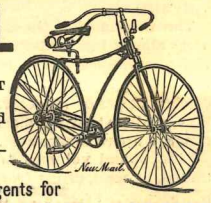
"THE GRAVES" **ELEVATORS.**
PASSENGER & FREIGHT
L. S. GRAVES & SON ROCHESTER N.Y.
NEW YORK, BOSTON, ST. LOUIS, DETROIT.

A NEW CATALOGUE —OF— VALUABLE PAPERS
Contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, New York.

WOODEN TANKS. FOR RAILROADS, WATER WORKS, MILLS, FARMS &C.
LARGE WATER TANKS. PLANS & ? A SPECIALTY.
SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS.
COMPLETE STOCK OF CYPRESS LUMBER.
W. E. CALDWELL & CO.
No 217 E. MAIN ST. LOUISVILLE KY.

THE STEAM ENGINE; ITS PRINCIples, its development, its future and perfection.—A paper by E. N. Dickerson, giving an outline of the history of the steam engine, and discussing the principles upon which it operates and which limit its capacity. With 2 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **686.** Price 10 cents. To be had at this office and from all newsdealers.

NEW MAIL
New Grade, $100.
CUSHION TIRES and TANGENT SPOKES.
Handsomest and Best Diamond Safety.
Send for Catalogue and Second-Hand List.



Also Sole New England Agents for
LITTLE GIANT
PRICE, $35.00.
Only Boy's Safety with a Spring Fork, preventing injury to young riders from jar and vibration.

WM. READ & SONS, **107 Washington St. BOSTON, MASS.**

THE Scientific American
ESTABLISHED 1846.
The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage. Weekly 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

—o—

THE Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers, and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy, Chemistry Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Single copies, 10 cents. Address, and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.
Publishers SCIENTIFIC AMERICAN.

—o—

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Sheets of Details, Estimates, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., Publishers,
361 Broadway, New York.

PRINTING INKS
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York